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UNITED STATES AIR FORCE

GRADUATE STUDENT RESEARCH PROGRAM

1989

PROGRAM MANAGEMENT REPORT

UNIVERSAL ENERGY SYSTEMS, INC.

Program Director, UES
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Submitted to

Air Force Office of Scientific Research

Bolling Air Force Base

Washington, DC

December 1989

PREFACE

The United States Air Force Graduate Student Resarch Program (USAF-GSRP) is conducted under the United Air Force Summer Faculty Research Program. The program provides funds for selected graduate students to work at an appropriate Air Force facility with a supervising professor who holds a concurrent Summer Faculty Research Program appointment or with a supervising Air Force Engineer/Scientist. This is accomplished by the students being selected on a nationally advertised competitive basis for a ten-week assignment during the summer intersession period to perfrom research at Air Force laboratories/centers. Each assignment is in a subject area and at an Air Force facility mutually agreed upon by the students and the Air Force. In addition to compensation, travel and cost of living allowances are also paid. The USAF-GSRP is sponsored by the Air Force Office of Scientific Research, Air Force Systems Command, United States Air Force, and is conducted by Universal Energy Systems, Inc.

The specific objectives of the 1989 USAF-GSRP are:

(1) To provide a productive means for the graduate students to participate in research at Air Force Laboratories/Centers;

(2) To stimulate continuing professional association among the graduate students and their professional peers in the Air Force;

(3) To further the research objectives of the United States Air Force;

(4) To enhance the research productivity and capabilities of the graduate students especially as these relate to Air Force technical interests.

During the summer of 1989, 102-graduate students participated. These researchers were assigned to 23 USAF laboratories/centers across the country. This three volume document is a compilation of the final reports written by the assigned students members about their summer research efforts.

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I. INTRODUCTION

Universal Energy Systems, Inc. (UES) was awarded the United States Air Force Summer Faculty Research Program on August 15, 1984. The contract is funded under the Air Force Systems Command by the Air Force Office of Scientific Research.

The program has been in existence since 1978 and has been conducted by several different contractors. The success of the program is evident from its history of expansion since 1978.

The Graduate Student Research Program (GSRP) is conducted as part of the Summer Faculty Research Program (SFRP).

The program provides opportunities for research in the physical sciences, engineering, and life sciences. The program has been effective in providing basic research opportunities to the Graduate Students of universities, colleges, and technical institutions throughout the United States.

The program is available to Graduate Students enrolled in either Masters Degree or Doctorate Programs. It has proven especially beneficial to the students who are starting their academic research programs.

When the GSRP was first started, graduate students were selected along with their professors to work on the program. A pilot program for Graduate Student Summer Research via the AFOSR Summer Faculty Research Program (SFRP) was initiated in 1982. The program was developed as an adjunct effort to the SFRP. Its purpose was to provide funds for selected graduate students to work at appropriate Air Force laboratories or centers with supervising professors who hold concurrent SFRP appointments.

Starting with the 1985 GSRP and again for the 1989 GSRP, emphasis was placed on selecting graduate students to be placed with either supervising professors on the SFRP or with the Air Force laboratory/center engineers/scientists. In 1989 there were 181 GSRP applicants. A total of 102 graduate students were selected to participate in the 1989 program. Since the initiation of the program in 1983, the program has expanded from 17 graduate students in 1983 to 102 in 1989. Table 1 lists the number of GSRP participants and demonstrates the growth of the program.

Year	Number of graduate students
1982	17
1983	53
1984	84
1985	92
1986	100
1987	101
1988	107
1989	102

Table 1 GSRP Participation Statistics

II. RECRUITING AND SELECTION

The program is conducted on a nationally advertised and competitive selection basis. Advertising for the 1989 program was conducted via direct mail to all accredited schools. The mailing was sent to the department chairman at the schools. The departments included biology, genetics, ecology, entomology, chemistry, computer science, graphics, mathematics, physics, aeronautical engineering, ceramic engineering, chemical engineering, materials science, mechanical engineering, electrical engineering, metallurgy, nuclear science, and psychology. The brochures were also mailed to all of the participants in the 1985, 1986, 1987, and 1988 SFRP and GSRP. Brochures were mailed to the Presidents of Historically Black Colleges. The brochures were sent to all participating USAF laboratories/centers; distribution was made through AFROTC units on university campuses; information was supplied to all who made requests. Overall, more than 17,000 brochures were distributed throughout the country.

Application deadline for the GSRP was April 1, 1989. The announcements of selections were mailed on April 15, 1989.

The 1989 SFRP is published as five separate documents. The reports are entitled Summer Faculty Research Program Management Report and Technical Reports, Volume I, II, III and IV.

III. SITE VISITS

Visits listed below include those by UES and AFOSR personnel. The faculty, USAF research colleagues, and student participants are generally satisfied with the program. Criticisms were: a) too much paper work to administer program, b) housing difficult to find, c) 10 weeks too short for research period.

June 20, 1989	Astronautics Laboratory Edwards Air Force Base, California
June 21, 1989	HRL: Operations Training Division Williams Air Force Base, Arizona
June 22, 1989	Weapons Laboratory Kirtland Air Force Base, New Mexico
June 23, 1989	Frank J. Seiler Research Laboratory United States Air Force Academy, Colorado
June 27, 1989	Rome Air Development Center Griffiss Air Force Base, New York
June 28, 1989	Electronic Systems Division Geophysics Laboratory Hanscom Air Force Base, Massachusetts
June 29, 1989	Wright-Patterson Air Force Base Dayton, Ohio

July 11, 1989	Arnold Engineering Development Center Arnold Air Force Base, Tennessee
July 12, 1989	Engineering Services Center Tyndall Air Force Base, Florida
July 13, 1989	Armament Division Eglin Air Force Base, Florida
July 14, 1989	School of Aerospace Medicine HRL: Training Systems Division HRL: Manpower and Personnel Division Occupational and Environment Health Laboratory Brooks Air Force Base, Texas

Because of the proximity of UES to Wright-Patterson Air Force Base, several site visits were made to the following laboratories:

Aero Propulsion Laboratory
Armstrong Aerospace Medical Research Laboratory
Avionics Laboratory
Flight Dynamics Laboratory
Human Resources Laboratory
Materials Laboratory
Wright-Patterson Air Force Base, Ohio

We find that the objectives of the GSRP are being well served. Summer Fellows indicate that they are performing independent research, and are not being used as "summer help". We have found no abuse of the non-personal services requirements. Research fellows often conduct lectures and seminars at the Air Force locations.

As a record of the documentation supplied to the appointees, the UES Information and Appointment Packets are provided in Appendix I of this report.

IV. HISTORICALLY BLACK COLLEGES/UNIVERSITIES (HBCU's)

In support of with the Summer Faculty Research Program, and as part of the UES EEO/Affirmative Action Program, UES sponsored an information booth at the NAFEO (National Association for Equal Opportunity in Higher Education) Conference. The conference was held on April 19 through 23, 1989. UES provided information on the UES-AFOSR summer programs at this conference.

The following statistics are presented as a demonstration of the success of the HBCU workshops. The number and quality of the HBCU applicants for the SFRP, GSRP, and Research Initiation Program speak for the success of this effort. UES does not have any data prior to the 1985 program year to include in this analysis.

Year	Number of HBCU SFRP Applicants	Number of HBCU GSRP Applicants	Number of HBCU RIP Applicants
1985	76	15	10
1986	70	20	16
1987	82	32	23
1988	53	23	8
1989	39	13	N/A

Year	Number of HBCU on SFRP	Number of HBCU on GSRP	Number of HBCU on RIP
1985	23	11	7
1986	18	10	10
1987	18	10	7
1988	17	14	4
1989	15	4	N/A

Table 2 HBCU Participation

APPENDIX I

This appendix presents the following documents which were distributed to appointees and other program participants.

A. Information Brochure for Summer Fellows.

B. Questionnaire for participants and a summary of their replies.

C. Questionnaire for Air Force laboratory representative and a summary of their responses.

D. Questionnaire for Research Colleague and a summary of their replies.

APPENDIX 1.A

INFORMATION BROCHURE

for

SUMMER FELLOWS

on the

1989 USAF-UES GRADUATE STUDENT RESEARCH PROGRAM

March 1989

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I. SUMMER FELLOW OBLIGATIONS

Universal Energy Systems, Inc. (UES) is required by contract to impose certain obligations on you in your status as a Summer Fellow. This section outlines those obligations, and you should read them thoroughly. Your are required to sign and return the statement of understanding before the final processing of your appointment can be completed. The following is a list.

1. Research Goals and Objectives: A statement of research objectives must be provided to UES PRIOR TO the start of the summer research period. It should outline your goals and the approach you intend to follow in researching these goals. Neither travel expenses nor expense allowances will be reimbursed until after receipt of your statement of research objectives. The report should also clearly indicate the date of your first working day of the summer research period. If you are working with a professor during the appointment, the goals and objectives may be the same as submitted by the professor.

2. Final Report: At the end of your summer research effort, you are required to submit to UES a completed, typewritten scientific report stating the objectives of the research effort, the approach taken, results, and recommendations. Information on the required report format will be sent to you with a "FINAL REPORT INFORMATION BULLETIN" and sample report illustrating a suggested format. The final report must first be approved by your Effort Focal Point and then transmitted so as to reach UES by Saturday, September 30, 1989. Payment of "Compensation" for the final two weeks of your ten-week research period cannot be made until UES has received and approved this report in the required format.

3. Program Evaluation Questionnaire: You will be sent a critique form to complete near the end of your research period regarding your impressions of the program. This critique form should be completed and returned to UES, along with your final report, by Saturday, September 30, 1989. The return of this form is a program requirement; it also must be received by UES before the final compensation payment can be made.

4. U.S. Air Force - Summer Fellow Relationship: The U.S. Air Force and UES understand and agree that the services to be delivered by Summer Fellows under this contract will be non-personal services and the parties recognize and agree that no employer-employee or master-servant relationships will exist between the U.S. Air Force and the Summer Fellows. Non-personal services are defined as work performed by an individual who is responsible for an end item, such as a report, free of supervision of the U.S. Air Force and free of an employer-employee relationship.

As a Summer Fellow, you will not:

(a) Be placed in a position where you are appointed or employed by a Federal Officer or are under the supervision, direction, or evaluation of a Federal Officer, military or civilian.

(b) Be placed in a staff or policy-making position.

(c) Be placed in a position of command, supervision, administration, or control over Air Force military or civilian personnel or personnel of other contractors or become a part of the U.S. Air Force organization.

The services to be performed under the GSRP do not require UES or the Summer Fellow to exercise personal judgement and discretion on behalf of the U.S. Air Force; rather, the Summer Fellows will act and exercise personal judgement and discretion on their research programs on the GSRP conducted by UES.

The Air Force will have unrestricted use of and access to all data developed during the period of this appointment.

II. ALLOWABLE TRAVEL EXPENSES

If you live outside of the area (50 miles) where you will be assigned for the summer program, the GSRP provides potential funding for the trip between your home and your assigned research location. As soon as you have signed and returned your appointment letter along with the budget sheet, you will be authorized to receive reimbursement for travel expenses as described below.

You are expected to make your own arrangements for this trip, and after the trip you may invoice UES for reimbursement of allowable expenses in the format described in the Instructions for Invoicing for Compensation and Reimbursement section of this brochure. Closely coordinate your travel plans with your EFFORT FOCAL POINT or your supervising professor.

All travel reimbursements under Summer Fellow appointments are made according to current UES policy, and deviations from the approved budget are not authorized and will not be reimbursed. In light of these restrictions, you may choose either to travel by common carrier at coach rates or less, by driving your private auto, or by a combination of both. With any of these choices you may claim reimbursement up to the amount for the most direct routing, taking into the account the desirability of routing on interstate highways if you drive your private auto.

Reimbursement for direct route travel by common carrier will be paid on your submission of an invoice to UES following the invoicing instructions referenced above. In the view of the convenience of having a car at the research location, UES strongly recommends that a private auto be used for travel when practical. Reimbursement when you drive your private auto is at the rate of 21¢ per mile within the above routing restrictions and will be paid on submission of a suitably prepared invoice. These reimbursements cannot be extended to cover travel by your family if they accompany you on either of these authorized trips.

During the ten week summer research period, you will be authorized to receive an expense allowance in lieu of a per diem payment at a rate of $32 per day for a maximum of 70 days. To receive this allowance, you must invoice for it and be living (50 miles) outside your area of residence.

These items above are the only reimbursable travel allowances authorized under the GSRP appointment. Any additional travel expenses incurred during the appointment period will be your personal responsibility.

UES has arranged with a travel office in Dayton, Ohio, to have the air fare costs of your travel on the GSRP charged directly to UES. For you to take advantage of this, you must call this travel service. The number in Dayton, Ohio, is 293-7444 or 1-800-628-6668. You must give the code SLI3 to have the tickets charged to UES.

If you require a cash advance for the start of the program, please indicate the amount on the bottom of your budget sheet. The cash advance will be deducted from payments of your bills of service.

III. INSTRUCTIONS FOR INVOICING FOR COMPENSATION AND REIMBURSEMENT

Attached is a copy of the Invoice Format that you are required to use to obtain compensation or reimbursement from UES. Note that all disbursements by UES for compensation, travel, and/or other expenses are subject to audit approval, so you must submit receipts substantiating charges invoiced.

In addition, you must prepare, sign, date and attach to each completed invoice a Brief Report of Effort

A. PREPARATION OF BRIEF REPORT OF EFFORT

Whenever you submit an Invoice for reimbursement to UES you must also include a brief report describing your activities for the invoice period. To meet this obligation, you must prepare, date, sign, and attach to your completed invoice a Brief Report of Effort describing the research accomplished on the appointment and explain any travel during the invoice period.

This report should describe innovative techniques and designs or discoveries which may be disclosed as patents. Rights to any inventions or discoveries shall reside with UES unless determined otherwise by the contracting agency.

The Brief report should never exceed one typewritten page and most often should be considerably shorter than one page.

B. PREPARATION OF INVOICE FORMAT

The financial items required on the Invoice Format are for COMPENSATION, TRAVEL, EXPENSE ALLOWANCE, AND PER DIEM.

Item (1) SOCIAL SECURITY/MAILING ADDRESS

Fill in your name, social security number, and address to which you wish to have your check mailed.

Item (2) COMPENSATION

(a) Indicate the dates for which you are claiming compensation, and indicate the number of days you are claiming for compensation.

(b) Multiply this number by $68.00 for B.S. degree holders and enter the total dollar amount in the blank total charges for service. The accumulated total number of days you claim on this appointment may not exceed the number authorized in your appointment letter.

Item (3) TRAVEL

(a) Under the heading Date indicate the date you departed on your trip and the date you arrived at your destination. If you are invoicing for a round trip, also list the date you departed on your trip and the date you arrived home.

(b) Under the heading Dept/Arrival Time list the departure and arrival times for the corresponding days you listed under Date.

(c) List your destination under the heading Destination.

(d) Under the heading Mode, indicate your principal means of conveyance; i.e., commercial air, private auto, etc

(e) Under the heading Amount, itemized these expenditures for travel reimbursement. Continue them on a separate sheet if necessary.

(f) Total these travel items and enter the dollar amount for travel in this invoice on the line to the right of Total Travel Expense.

Item (4) EXPENSE ALLOWANCE

This item on the invoice will be used to claim the $32 per day for reimbursement of costs incurred at your assigned research location.

(a) In the first blank to the right of EXPENSE ALLOWANCE enter the number of days for which you are claiming the expense allowance at your assigned research location.

(b) Multiply this number by the daily allowance rate of $32.00 and enter this total dollar amount in the blank at the far right.

(c) Itemize the days for which you are claiming the Expense allowance reimbursement. It can include weekend days and holidays as well as regular work days.

Item (5) PER DIEM

This item is not applicable to the GSRP.

Item (6) INSTRUCTIONS

You may combine reimbursement requests for compensation, travel, and Per diem or expense allowance in the same invoice. The total for all items invoiced should be indicated on the blank on the right hand side of line 7.

If you have arranged your travel through the UES travel office as described on page 4, please indicate the cost of the tickets on this line.

IMPORTANT: Indicate in the space provide on each invoice the address to which you want the check mailed.

You must sign and date your invoice in the lower left hand corner as "Summer Fellow" before it is submitted; you MUST also have your Effort Focal Point countersign the invoice before it is mailed to UES Your Effort Focal Point is an Air Force individual at your research location who will be identified prior to your effort start date.

Invoices should be mailed to:

Universal Energy Systems, Inc.
GSRP Office
4401 Dayton-Xenia Road
Dayton, Ohio 45432

IV

BILL FOR SERVICE

1. _____ _____
Name (First, Initial, Last) Social Security #

_____
Address (Street, City, Zip)

SERVICE: GSRP Summer Fellow

SERVICE AUTHORIZED BY: Rodney C. Darrah

RATE AUTHORIZED: $68.00/day for B.S. Degree

This service is for:
Government Contract: Project # 210
Government Contract No. F49620-88-C-0053

2. DATES OF SERVICE: _____ TOTAL DAYS OF SERVICE _____
TOTAL CHARGES FOR SERVICE: _____

ADDITIONAL ITEMIZED REIMBURSABLE EXPENSES:
(copies of airfare receipts are required)

3. TRAVEL: DATE _____ DEPT/ARRIVAL TIME _____
DESTINATION_____MODE_____AMOUNT_____

4. EXPENSE ALLOWANCE: (_____ days at $32.00/day) $_____

5. PER DIEM: (Not Applicable)

6. TOTAL AMOUNT OF BILL: _____

7. AIR FARE TICKETS CHARGED DIRECTLY TO UES. AMOUNT: $_____

_____ _____
Summer Fellow Signature - Date Telephone

Invoice Approval: _____
Effort Focal Point Signature

X_____ Brief Report of Effort
Type or Print Name Attached _____

Location: _____

Telephone: _____ Date: _____

Send bill to:
UNIVERSAL ENERGY SYSTEMS, INC.
ATTN: GSRP Office
4401 Dayton-Xenia Road
Dayton, Ohio 45432

In order for UES to provide quick turn around of your bills for service, we request your assistance in complying with the following schedule. The dates indicated are the dates your bills MUST be at UES. Please allow adequate mailing time for UES to receive your bills by the dates indicated
for 1989

DATES BILLS MUST BE AT UES	DATES CHECKS WILL BE MAILED
April 6, 21	April 17, May 1
May 8, 23	May 15, 30
June 8, 22	June 15, 30
July 6, 21	July 17, 30
August 8, 23	August 15, 30
September 8, 22	September 15
October 5, 23	October 2, 16, 30
	November 15, 30

For bills received on or before these dates, UES will be able to process checks to you in the mail by the 15th and 30th. For bills received after these dates, the checks may not be processed until the next pay period, causing a two week delay in your receiving your check.

Your bill may be for any period of time. It does not have to start on a Monday or end on a Friday. Your bill may be for any period convenient for you to meet our billing dates listed above. Please note these are the dates the bill must be at UES. For example, a bill received on or before April 6 will be mailed out to you on April 17. A bill received on April 7 will not be mailed until the April 21 bills are processed on May 1.

APPENDIX 1.B

PARTICIPANT'S QUESTIONNAIRE REPLY SUMMARY

1989 USAF/UES GRADUATE STUDENT RESEARCH PROGRAM
EVALUATION RESPONSE

A. TECHNICAL ASPECTS

1. Assignment in field of competency and/or interest?

   Yes - 100
   No - 1

2. Was the work challenging?

   Yes - 97
   No - 3

   If no, why?

   Project not organized; research at data collection level - clerical work.

3. Were your relations with your colleagues satisfactory?

   Yes - 99
   No - 3

   If no, why?

4. Suggestions for improvement of relationship(s).

   Pre summer visits, more interaction with researchers; more social meetings; have UES coordinator at lab.

5. Were you afforded adequate facilities?

   Yes - 93
   No - 7

6. Accomplishment in 10 weeks?

   more than - 17
   less than - 27
   about what you expected - 56

7. Do you feel the Graduate Student appointment should continue to require affiliation with a Summer Research Faculty Member?

Yes - 69
No - 28

8. Were you asked to present seminars?

Yes - 53
No - 47

9. Were you asked to participate in meetings?

Yes - 53
No - 47

10. Please give other comments concerning any "extra" activities.

A few indicated that more meetings and better coordination at the lab would help. Several indicated they attended conferences/lectures at the lab. A few indicated that tours of the facilities were interesting. One indicated participation in softball.

11. On a scale of A to D, how would you rate this program? (A high, D low)

Technically challenging	A-56	B-41	C-3	D-0
Future research opportunity	A-55	B-35	C-7	D-2
Professional association	A-66	B-25	C-8	D-1
Enhancement of my academic qualifications	A-66	B-21	C-9	D-3
Enhancement of my research qualifications	A-79	B-18	C-2	D-1
Overall value	A-72	B-27	C-1	D-0

B. ADMINISTRATIVE ASPECTS

1. How did you first hear of this program?

Colleagues - 90
Advertisement - 6
Air Force - 0
Direct Mail - 5

2. Decisive aspect of application?

NOTE, MANY PUT MORE THAN ONE ANSWER

Area of possible future research funding	- 3
Good research opportunity	- 74
Opportunity to work with USAF	- 21
Location	- 8
Financial support	- 13
Lead to a thesis	- 9

3. Stipend level? Generous - 27
Adequate - 72
Meager - 1

4. Housing information?

VOQ - 9
Apartment - 50
Other - 41

5. Would you encourage or discourage expansion of the Student Program?

Encourage - 94
Why?

Most comments mentioned the research experience, the professional associations/developments, and/or the learning situation. Many mentioned the insight gained in defense related research. Several indicated the use of state-of-the-art equipment. One mentioned the development of self discipline. Several suggested that the GSRP promotes U.S. citizens to enter/continue graduate school.

Discourage - 4
Why?

One suggested the fewer the number of participants, the more prestigious the appointment. The others indicated that the laboratory researchers time/resources limited the number of participants.

6. Program administration overall rating?

Excellent - 56
Good - 41
Fair - 2
Poor - 0

7a. Comments on the strong points of the program:

Most mentioned the research, research freedom, research contacts, and/or research equipment/resources. Several mentioned the professional development and interaction with Air Force researchers. A few indicated they used the opportunity to select a thesis topic. Several mentioned the clarity of the UES billing/payment schedule.

7b. Comments on the weak points of the program:

Many indicated 10 weeks are too little time. Several indicated housing problems. Several indicated confusion over taxes. A few mentioned no interaction with other GSRP fellows. A few complained of the payroll process and billing and payment schedule. A few indicated that the program is not widely known on campus. Other weaknesses indicated were lack of help with maps and housing, the bureaucracy, the final report requirement, no regular meetings and loneliness. Other weaknesses mentioned were specific to research problems faced by fellows.

8. Has this been a fruitful, worthwhile, constructive experience?

Yes - 100
No - 0

9. Other remarks.

Many mentioned the excellence of the program, using words such as enjoyable, valuable, etc. Suggestions for improvement included:

providing funds for dissertations;
help with taxes;
more social activities;
longer research period;
provide pre-summer visit;
provide a local paying service;
expand the program to include high school teachers;
UES to provide more than 10% cash advance.

Also included in the comments were:

UES coordinator at base makes start up easy;
researcher/co-worker were cooperative;
plans to participate in program again.

One student indicated that this was hopefully the start of a longer relationship with the Air Force. Another indicated that as a result of the participation in the GSRP, the lab has made an offer of employment, and the student has accepted the offer.

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APPENDIX 1.C

LABORATORY REPRESENTATIVE'S REPLY SUMMARY

1989 USAF/UES SUMMER FACULTY RESEARCH PROGRAM
EVALUATION QUESTIONNAIRE LABORATORY REPRESENTATIVE

1. How do you rate the correspondence, verbal and telephone communication, and other aspects concerning program administration?

Excellent - 9
Good - 8
Average - 3
Poor - 0
No Response - 0

How could it be improved?

Correspondence and communications are rated highly acceptable for this program. The only suggestion for improvement demonstrates general unfamiliarity with this program and may be an isolated instance. Recommendation: Follow up with each assignment to assure that all participants know what their responsibilities are and the responsibilities of those directly involved. This should be done early and may be at the risk of repetition.

2. Did you have sufficient time to conduct an evaluation of applications?

Yes - 17
No - 2

Comments?

The answers to question #2 suggests that adequate time is presently available to evaluate applicants and no change is indicated.

3. Was the number of faculty researchers assigned to your organization satisfactory?

Yes - 11
No - 6
No Answer 1

If no, how many would be desired?

The number of faculty researchers is presently right for most organizations. These organizations would like the number to be based on the number of divisions in the Laboratory. The limit on numbers should be defined by the cost and available funds. The Weapons Lab suggested that the laboratory should have the option of funding additional faculty researchers.

4. Please rate the expense-paid pre-program visit:

Essential	- 18
Convenient	- 1
Not worth expense	-
No answer	- 1

The pre-program visit is essential to the success of the program and should continue.

5. In your opinion, is the ten week period an optimum length of time to develop a viable working relationship among the faculty researchers, students, laboratory/center personnel and program?

Yes - 10
No - 8
N/A - 2

Other comments:

Most will agree that the researchers will use all the time they are given. Ten weeks is apparently minimally acceptable, especially considering the mini-grant program. Twelve would be better and would allow one week to get organized and a week for report writing.

6. Did your laboratory/center establish a seminar program, or other means, to "tap" the faculty associate's academic knowledge other than his research assignment?

Yes - 9
No - 9
No Answer 2

If yes, give description and evaluation?

The means of access to knowledge of visiting faculty was not well developed by the laboratories. Though the seminar is a popular means, it was not used very much. Some emphasis is needed if this aspect is important. One idea from two of the labs included a session during lunch, as often as weekly, to bring participants and lab personnel together. The School of Aerospace Medicine used "brown bag" lunches on Wednesdays. This seems to take the least amount of planning and preparation and is least cumbersome.

7. Did the laboratory/center conduct a general briefing, tour, and/or other formal means of welcome and introduction for the associate assigned to your organization?

Yes - 15
No - 5

Most of the laboratories provided some welcome and introduction to the faculty. Recommend that the local coordinator be provided the challenge to welcome each of the associates and suggest that the focal points be responsible to the associate for introduction to the technical area. This is most likely being done, but not as part of a "formal" welcome.

8. Did you have a formal exit exercise for each associate such as a final technical briefing presented to the organization management, a private interview, or other?

Yes - 13
No - 6
No Answer 1 (varied by division)

There was a formal outbrief most of the time. One comment indicated these interviews were accomplished in the division.

9. In your opinion, what was the overall quality of this year's participants as measured by attitude, technical competence, work habits, production and meaningful research accomplishment?

Superior - 48
Excellent - 62
Average - 6
Poor - 1

Most of the participants were rated excellent or superior. Only one participant was rated "poor" with no other comment.

10. Do you believe the Graduate Student Research Program enhances the Summer Research Program?

Yes - 19
No -
N/A - 1

The Graduate Student Research Program is considered a valuable part of the Summer Research Program and should continue.

11. Was a student assigned under the Graduate Student Research Program to your laboratory this summer?

Yes - 19
No -
N/A - 1

If so, was their participation productive?

Yes - 18
No -

See comment on question #10 above.

12. Please furnish any recommendations you may have on improving the Graduate Student segment of the program.

A summary of the various comments received include:

1. Need to advertise in the student magazines (e.g. American Institute of Aeronautics and Astronautics, Student Journal, 370 L'Enfant Promenade, SW, Wash, D.C.).
2. Better to have graduate student accompany faculty member.
3. Try to coordinate specific thesis interest.
4. Give clear instructions on program and contacts in labs.
5. Have the local UES coordinator contact each student with area information before their site visit.
6. Program went well. Had four graduate students accompanied by faculty. Better for them and better for us.

13. Site visits were made by Program Director and/or Administrator and the AFOSR representative. Do you feel these visits are beneficial to the program participants and Laboratory in understanding the management of the program?

Yes - 15
No - 1
N/A - 4

Do you think these visits should be done again next year?

Yes - 15
No - 1

There was overwhelming support for visits by AFOSR and UES. Visits were beneficial and should be continued.

14. UES has a coordinator assigned at your base to assist the Summer Faculty participants in the administration of the program. Did you find this beneficial to the program?

Yes - 11
No - 1
N/A - 8

Where a coordinator is assigned, he\she was beneficial.

Are there any problem areas coordinators should administer in future years?

Improvement in the communication with the participants is still indicated in some instances. Also, the coordinator could possibly negotiate for some dormitory space in local universities/colleges during the summer, especially where housing is not really affordable.

15. Please furnish any other comments or suggestions to improve the program in future years.

1. This program is beneficial to all.
2. One significant source indicated shortage of engineering expertise and suggested that if pay is the reason, something should be done to increase the pay.
3. Some of the comments indicate frustration with paperwork. (One respondent indicated that they were merely the distribution point and another claimed the program was using an inadequate questionnaire.)

APPENDIX II

A. Program Statistics

B. List of 1989 Participants

C. Participant Laboratory Assignments

APPENDIX II A

Summer Faculty Research Program
Graduate Student Research Program

Sponsored by
Air Force Office of Scientific Research

Conducted by
Universal Energy Systems, Inc.

Program Statistics

Program Statistics

1. Applications Received (by Laboratory)

Organization		1st Choice
Aerospace Medical Research Laboratory	(WPAFB)	15
Aero Propulsion Laboratory	(WPAFB)	9
Armament Laboratory	(Eglin)	5
Arnold Engineering Development Ctr.	(Arnold)	10
Astronautics Laboratory	(Edwards)	15
Avionics Laboratory	(WPAFB)	10
Eastern Space & Missile Center	(Patrick)	0
Electronic Systems Division	(Hanscom)	7
Engineering and Services Center	(Tyndall)	3
Flight Dynamics Laboratory	(WPAFB)	9
Frank J. Seiler Research Laboratory	(USAFA)	6
Geophysics Laboratory	(Hanscom)	4
Human Resources Laboratories	(Brooks)	14
Materials Laboratory	(WPAFB)	18
Occupational & Environment Health Lab.	(Brooks)	2
Rome Air Development Center	(Griffiss)	18
School of Aerospace Medicine	(Brooks)	20
Weapons Laboratory	(Kirtland)	10
Wilford Hall Medical Center	(Lackland)	6
	Totals	181

2. Number of Participants - 102

Number with Bachelors Degree - 77
Number with Masters Degree - 24
Number with Doctorate Degree - 1

Program Statistics
Continued

3. Number of Participants at Each Laboratory

Organization		
Aerospace Medical Research Laboratory	(WPAFB)	9
Aero Propulsion Laboratory	(WPAFB)	6
Armament Laboratory	(Eglin)	3
Arnold Engineering Development Ctr.	(Arnold)	8
Astronautics Laboratory	(Edwards)	6
Avionics Laboratory	(WPAFB)	6
Eastern Space & Missile Center	(Patrick)	0
Electronic Systems Division	(Hanscom)	4
Engineering and Services Center	(Tyndall)	2
Flight Dynamics Laboratory	(WPAFB)	6
Frank J. Seiler Research Laboratory	(USAFA)	5
Geophysics Laboratory	(Hanscom)	3
Human Resources Laboratories	(Brooks, Williams, and WPAFB)	6
Materials Laboratory	(WPAFB)	9
Occupational & Environment Health Lab.	(Brooks)	2
Rome Air Development Center	(Griffiss)	7
School of Aerospace Medicine	(Brooks)	10
Weapons Laboratory	(Kirtland)	6
Wilford Hall Medical Center	(Lackland)	4
	Totals	102

4. Discipline Represented -

Aerospace Engineering	- 6	Engineering	- 1
Applied Mathematics	- 2	Geology	- 1
Applied Physics	- 1	Industrial Engineering	- 2
Atmospheric Science	- 1	Literature	- 1
Bicchemistry	- 3	Manufacturing Eng.	- 1
Biology	- 10	Materials Engineering	- 3
Chemical Engineering	- 2	Mathematics	- 6
Chemistry	- 3	Mechanical Engineering	- 11
Civil Engineering	- 3	Meteorology	- 1
Computer Science	- 4	Philosophy	- 1
Economics	- 1	Physical Science	- 1
Education	- 1	Physics	- 10
Electrical Engineering	- 19	Psychology	- 6
		Zoology	- 1
		Total	- 102

Program Statistics
Continued

5. Colleges and Universities Represented - Total 64

Akron, University of	- 1	New Hampshire, University of	- 1
Alabama, University of	- 3	New Mexico, University of	- 1
Arizona State University	- 1	New York University	- 1
Boston College	- 1	North Carolina State Univ.	- 1
Bowling Green State University	- 1	Northern Colorado, Univ. of	- 1
Buffalo, University of	- 1	Notre Dame, University of	- 1
California State University	- 1	Ohio State University	- 3
California, University of	- 1	Ohio University	- 3
Central Florida, Univ. of	- 1	Oklahoma State University	- 1
Central State University	- 1	Oklahoma, University of	- 1
Cincinnati, University of	- 2	Oregon Institute of Tech.	- 3
Cornell University	- 2	Pennsylvania State Univ.	- 1
Dayton, University of	- 3	Rackman Graduate School	- 1
Eastern Washington University	- 1	San Jose State University	- 1
Florida, University of	- 3	Scranton University	- 2
Georgia Inst. of Technology	- 1	South Carolina, Univ. of	- 1
Illinois Inst. of Technology	- 1	Southern Illinois University	- 1
Illinois State University	- 1	Southwestern Louisiana Univ.	- 1
Illinois, University of	- 3	Syracuse University	- 1
Indiana Univ. of Pennsylvania	- 1	Tennessee Space Institute	- 1
Kansas State University	- 2	Tennessee Tech. University	- 1
Kent State University	- 2	Texas A&M University	- 9
Kentucky, University of	- 1	Texas-San Antonio, Univ. of	- 2
Louisiana State University	- 1	Trinity University	- 2
Lowell, University of	- 1	Vanderbilt University	- 3
Meharry Medical College	- 3	Virginia Polytechnic Instit.	- 1
Miami University	- 1	Washington State University	- 1
Miami, University of	- 1	West Florida, University of	- 1
Middle Tennessee State Univ.	- 3	Western Illinois University	- 1
Minnesota-Duluth, Univ. of	- 1	Wichita State University	- 1
Missouri-Rolla, Univ. of	- 2	Worcester Polytechnic Inst.	- 1
Murray State University	- 1	Wright State University	- 4
		Total	102

Program Statistics
Continued

6. States Represented - Total 29

Alabama	- 3
Arizona	- 1
California	- 3
Colorado	- 1
Florida	- 6
Georgia	- 1
Illinois	- 9
Indiana	- 2
Kansas	- 2
Kentucky	- 3
Louisiana	- 2
Maryland	- 1
Massachusetts	- 3
Minnesota	- 1
Missouri	- 2
Nebraska	- 1
New Hampshire	- 1
New Jersey	- 2
New Mexico	- 1
New York	- 6
North Carolina	- 1
Ohio	- 18
Oklahoma	- 2
Oregon	- 3
Pennsylvania	- 4
South Carolina	- 1
Tennessee	- 7
Texas	- 13
Washington	- 2

7. Age of Participants -

Average - 27

APPENDIX II B

LIST OF PARTICIPANTS

LIST OF 1989 PARTICIPANTS

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Ben Abbott Vanderbilt Univ. Electrical Eng. Dept. Nashville, TN 37240 (615) 322-6588	Degree: BS Specialty: Computer Science Assigned: Arnold Engineering Development Center
Sudarkodi Alagarsamy Trinity University 715 Stadium San Antonio, TX 78284 (512) 736-7011	Degree: BS Specialty: Biochemistry Assigned: School of Aerospace Medicine
Julie Albertson Washington State Univ. Sloan 201 Pullman, WA 99164 (509) 335-8654	Degree: MS Specialty: Mechanical Eng. Assigned: Frank J. Seiler Research Lab.
David Alden Cincinnati, Univ. of 408A Rhodes Hall Cincinnati, OH 45221 (513) 556-3701	Degree: MS Specialty: Metal. Engineering Assigned: Materials Laboratory
Darren Allen Middle Tennessee State Univ. Dept. of Mathematics Murfreesboro, TN 37132 (615) 898-2669	Degree: MS Specialty: Mathematics Assigned: Arnold Engineering Development Center
Mojdeh Anderson Cornell University Phillips Hall Ithaca, NY 14853 (607) 255-1445	Degree: BS Specialty: Physics Assigned: Frank J. Seiler Research Lab.
David Andreshak Illinois, Univ. of 101 Transportation Bldg. Urbana, IL 61801 (217) 333-2651	Degree: BS Specialty: Aerospace Engineering Assigned: Weapons Laboratory

Fred Arnold
Michigan, University of
Rackman Graduate School
Ann Arbor, MI 48109
(318) 764-4437

Degree: BS
Specialty: Physics
Assigned: Aero Propulsion Laboratory

John Baker
Kentucky, Univ. of
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Degree: BS
Specialty: Mechanical Eng.
Assigned: Flight Dynamics Laboratory

John Bambery
Indiana Univ. at Penn.
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Indiana, PA 15705
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Degree: BS
Specialty: Physics
Assigned: Avionics Laboratory

Rosemary Barbaro
Dayton, Univ. of
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Dayton, OH 45432
(513) 254-4444

Degree: BS
Specialty: Biology
Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory

Brian Bennett
Middle Tennessee State Univ.
Computer Sci. Dept.
Murphreesboro, TN 37132
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Degree: BS
Specialty: Electrical Eng.
Assigned: Arnold Engineering Development Center

Robert Bolton
Texas A&M Un[illegible]
EDG Area
College Station, TX 77843
(409) 845-0588

Degree: MS
Specialty: Civil Eng.
Assigned: Weapons Laboratory

Darwin Boyd
Kent State Univ.
Smith Laboratory of Physics
Kent, OH 44242
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Degree: MS
Specialty: Physics
Assigned: Materials Laboratory

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Degree: BS
Specialty: Mechanical Eng.
Assigned: Materials Laboratory

John Butemeyer
Texas A&M Univ.
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Degree: MS
Specialty: Psychology
Assigned: Human Resources Laboratory: Manpower & Personnel Division

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Kansas State Univ.
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Degree: MS
Specialty: Computer Sci.
Assigned: Avionics Laboratory

Paul Calvo
Scranton, Univ. of
Biology Dept.
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Degree: BS
Specialty: Biology
Assigned: School of Aerospace Medicine

Keith Carroll
Oregon Instit. of Tech.
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Degree: BS
Specialty: Electronical Eng.
Assigned: Electronic Systems Division

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Degree: BS
Specialty: Physical Science
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Degree: BS
Specialty: Chemistry
Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory

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Degree: BS
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Degree: BS
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Specialty: Economics
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Specialty: Mathematics
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Assigned: Astronautics Laboratory

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Degree: BS
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Degree: BS
Specialty: Mechanical Engineering
Assigned: Frank J. Seiler Research Lab.

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Degree: BS
Specialty: Mathematics
Assigned: Arnold Engineering Development Center

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Degree: BS
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Assigned: Electronic Systems Division

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Assigned: School of Aerospace Medicine

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Assigned: Materials Laboratory

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Degree: BS
Specialty: Electrical Engineering
Assigned: School of Aerospace Medicine

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Specialty: Electrical Engineering
Assigned: Rome Air Development Center

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Degree: BS
Specialty: Metal. Engineering
Assigned: Materials Laboratory

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Degree: MS
Specialty: Biochemistry
Assigned: Wilford Hall Medical Center

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Degree: MS
Specialty: Electrical Engineering
Assigned: Geophysics Laboratory

Sonja Schillmoeller
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Degree: BS
Specialty: Aero. Engineering
Assigned: Astronautics Laboratory

Royce Simpson
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Degree: BS
Specialty: Psychology
Assigned: Human Resources Laboratory:
Operations Training Division

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Degree: MS
Specialty: Electrical Engineering
Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory

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Degree: BS
Specialty: Electrical Engineering
Assigned: Arnold Engineering Development Center

Richard Swift
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Degree: BS
Specialty: Aeronautical Engineering
Assigned: Flight Dynamics Laboratory

Lynda Tomlinson
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Degree: MS
Specialty: Electrical Engineering
Assigned: Rome Air Development Center

George Tompkins
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Degree: BS
Specialty: Industrial Engineering
Assigned: Materials Laboratory

Mona Toms
Wright State Univ.
Applied Behavior Sci.
Dayton, OH 45435
(513) 873-2310

Degree: BS
Specialty: Psychology
Assigned: Human Resources Laboratory: Logistics & Human Factors

Robert Tramel
Tennessee Space Instit.
Dept. of Mathematics
Tullahoma, TN 37388
(615) 455-0631

Degree: BS
Specialty: Physics
Assigned: Arnold Engineering Development Center

Scott VanDam
Central Florida, Univ. of
PO Box 2500
Orlando, FL 32816
(407) 275-2416

Degree: MS
Specialty: Electrical Engineering
Assigned: Aero Propulsion Laboratory

Ronald VanEtten
Illinois State Univ.
Normal, IL 61761
(309) 452-6529

Degree: BS
Specialty: Education
Assigned: Human Resources Laboratory: Manpower & Personnel Division

John Wagnon
Oklahoma State Univ.
2001 N. Perkins #M135
Stillwater, OK 74075
(405) 743-3750

Degree: BS
Specialty: Electrical Engineering
Assigned: Rome Air Development Center

Glenn Waguespack
Louisana State Univ.
736 Dentation Dr.
Baton Rouge, LA 70808
(504) 766-1271

Degree: BS
Specialty: Mechanical Engineering
Assigned: Armament Laboratory

Matthew Westerheide
Missouri-Rolla, Univ. of
Thomas Jefferson Hall
Room 729
Rolla, MO 63138
(314) 341-5740

Degree: BS
Specialty: Electrical Engineering
Assigned: Astronautics Laboratory

John Williamson
Texas A&M Univ.
Dept. of Psychology
College Station, TX 77843
(409) 845-2581

Degree: BS
Specialty: Psychology
Assigned: Human Resources Laboratory: Training Systems

Raymond Wolfe
Scranton, Univ. of
423 Madison Ave.
Scranton, PA 18510
(717) 342-3402

Degree: BS
Specialty: Biology
Assigned: School of Aerospace Medicine

Jon Zern
Florida, Univ. of
Box J-125
Gainesville, FL 32610
(904) 392-2381

Degree: BS
Specialty: Biology
Assigned: Engineering Services Center

Joseph Ziegler
Florida, Univ. of
Dept. of Civil Eng.
Gainesville,FL 32611
(904) 392-3261

Degree: BS
Specialty: Civil Engineering
Assigned: Engineering Services Center

APPENDIX II C

PARTICIPANT LABORATORY ASSIGNMENT

C. PARTICIPANT LABORATORY ASSIGNMENT (Page 1)

1989 USAF/UES GRADUATE STUDENT RESEARCH PROGRAM

AERO PROPULSION LABORATORY (WRDC/APL)
(Wright-Patterson Air Force Base)

1. Fred Arnold
2. Duane Daddis
3. Robert Gabruk
4. Jon Longtin
5. John McCord
6. Scott VanDam

ARMAMENT LABORATORY (ATL)
(Eglin Air Force Base)

1. Randall Hodgson
2. William Newbold
3. Glenn Waguespack

HARRY G. ARMSTRONG AEROSPACE MEDICAL RESEARCH LABORATORY (AAMRL)
(Wright-Patterson Air Force Base)

1. Rosemary Barbaro
2. J. Matthew Clemens
3. Vincent Dimiceli
4. Lawrence Fleischer
5. Ellen Goldey
6. David Harper
7. Deborah Hollenbach
8. Laura Pytel
9. Janet Slifka

ARNOLD ENGINEERING DEVELOPMENT CENTER (AEDC)
(Arnold Air Force Base)

1. Ben Abbott
2. Darren Allen
3. Brian Bennett
4. Judy Dye
5. Lester Lynd
6. Betty Pipes
7. Richard Souder
8. Robert Tramel

ASTRONAUTICS LABORATORY (AL)
(Edwards Air Force Base)

1. Christopher Kocher
2. David Lapioli
3. Patricia Liu
4. Randy Nguyen
5. Sonja Schillmoeller
6. Matthew Westerheide

AVIONICS LABORATORY (Avionics Laboratory)
(Wright-Patterson Air Force Base)

1. John Bambery
2. Eric Byrne
3. Michael Costarella
4. Michael Findler
5. Diana Major
6. Douglas Melton

ELECTRONIC SYSTEMS DIVISION (ESD)
(Hanscom Air Force Base)

1. Keith Carroll
2. Bradley Herman
3. Douglas Pederson
4. George Ramlow

ENGINEERING AND SERVICES CENTER (ESC)
(Tyndall Air Force Base)

1. Jon Zern
2. Joseph Ziegler

C. PARTICIPANT LABORATORY ASSIGNMENT (Page 2)

FLIGHT DYNAMICS LABORATORY (FDL)
(Wright-Patterson Air Force Base)

1. John Baker
2. Kerry Christopher
3. Nancy Faulkner
4. Bryan Foos
5. Genevieve Huston
6. Richard Swift

FRANK J. SEILER RESEARCH LABORATORY (Frank J. Seiler Research Lab.)
(USAF Academy)

1. Julie Albertson
2. Mojdeh Anderson
3. Bradley Combs
4. Stephen McClain
5. Hao Pham

GEOPHYSICS LABORATORY (Geophysics Laboratory)
(Hansom Air Force Base)

1. Patrick Fitzpatrick
2. Matthew Jacobson-Carroll
3. David Sanborn

HUMAN RESOURCES LABORATORY
(Brooks, Williams and Wright-Patterson Air Force Bases)

1. John Butemeyer
2. Alice Horton
3. Royce Simpson
6. Mona Toms
7. Ronald Van Etten
8. John Williamson

MATERIALS LABORATORY (ML)
(Wright-Patterson Air Force Base)

1. David Alden
2. Darwin Boyd
3. Marcia Boyle
4. Charles Gray
5. Dean Hofmann
6. Neal Jahren
7. Rex Ramsier
8. James Sago
9. George Tompkins

OCCUPATIONAL AND ENVIRONMENT HEALTH LABORATORY (OEHL)
(Brooks Air Force Base)

1. William Jefferson
2. Lisa Newberg

C. PARTICIPANT LABORATORY ASSIGNMENT (Page 3)

ROME AIR DEVELOPMENT CENTER (Rome Air Development Center)
(Griffiss Air Force Base)

1. Scott Coffin
2. Randal Mandock
3. Timothy Mavor
4. William Patience
5. Ernest Rho
6. Lynda Tomlinson
7. John Wagnon

SCHOOL OF AEROSPACE MEDICINE (School of Aerospace Medicine)
(Brooks Air Force Base)

1. Sudarkodi Alagarsamy
2. Paul Calvo
3. Brian Davis
4. Dagmar Fertl
5. George Kim
6. Teresa Lee
7. Cynthia Moorhead
8. Lional Ramos
9. Joseph Rea
10. Raymond Wolfe

WEAPONS LABORATORY (Weapons Laboratory)
(Kirtland Air Force Base)

1. David Andreshak
2. Robert Bolton
3. Stuart Harbert
4. Toby Martin
5. Walter McCarter
6. Mary Nickels

WILFORD HALL MEDICAL CENTER (Wilford Hall Medical Center)
(Lackland Air Force Base)

1. Terrance Jorden
2. John Lafferty
3. Paula Mellon
4. John Salinas

APPENDIX III

A. Listing of Research Reports Submitted in the 1989 Graduate Student Research Program

B. Abstracts of the 1989 Summer Fellow's Research Reports

APPENDIX III A

LIST OF RESEARCH REPORTS

RESEARCH REPORTS

1989 GRADUATE STUDENT RESEARCH PROGRAM

Technical Report Number	Title	Graduate Researcher
Volume I		
Armament Laboratory		
1	Laser Polarimeter Development	Randall Hodgson
2	Euler Solutions to Transonic Flow Past an Ogive-Cylinder Body with Wraparound Fins	William Newbold
3	Observations and Improvements of Ballistic Stress Analysis Techniques	Glenn Waguespack
Arnold Engineering Development Center		
4	Distributed and Parallel Image and Signal Processing *** Same Report as Dr. Wilkes ***	Ben Abbott
5	Latin Hyper-Cube Sampling with Regression Analysis for Prediction of Engine Infrared Observables	Darren Allen
6	A General Purpose Two Dimensional Plotting Program	Brian Bennett
7	Matrix Inversions of Candidate Geometries for Application of CT Emission Techniques to Broad Band Radiative Transfer	Judy Dye
8	Distributed and Parallel Image and Signal Processing *** Same Report as Dr. Wilkes ***	Lester Lynd
9	A Survey of the Personal Computer Environment at Arnold Engineering Development Center	Betty Pipes
10	Distributed and Parallel Image and Signal Processing *** Same Report as Dr. Wilkes ***	Richard Souder
11	A Nonlinear Filter and an Odd/Even Iteration for Inviscid Fluid Flow Equations	Robert Tramel

Astronautics Laboratory

12	The Effects of Elevated Temperature Exposure on the Strength and Microstructure of 2-D Carbon-Carbon	Christopher Kocher
13	Vibration Control of a Cantilevered Beam Using a Distributed Actuator	David Lapioli
14	Using the STM to Characterize the Effects of Surface Treatments on the Surface Morphology of Carbon Fibers	Patricia Liu
15	Finite Element Model for Astrex	Randy Nguyen
16	Modeling of Combustion Instability in Solid Rocket Motors	Sonja Schillmoeller
17	State Variable Control of a Flexible Grid Structure	Matthew Westerheide

Electronic Systems Division

18	Carrier Free Radar *** Same Report as Beryl Barber ***	Keith Carroll
19	Analysis of Testability Concepts and its Application to RSIP *** Same Report as Dr. S. Natarajan ***	Bradley Herman
20	Carrier Free Radar *** Same Report as Dr. Beryl Barber ***	Douglas Pederson
21	Carrier Free Radar *** Same Report as Dr. Beryl Barber ***	George Ramlow

Engineering and Services Center

22	Effects of Jet Aircraft Noise on Domestic Goats	Jon Zern
23	Contaminant Flux Reduction Through In Situ Solubility Modification *** Same Report as Dr. Kirk Hatfield ***	Joseph Ziegler

Frank J. Seiler Research Laboratory

24	An Investigation of Dynamic Stall Vortex Characteristics *** Same Report as Dr. Troutt ***	Julie Albertson

Frank J. Seiler Research Laboratory (continued)

25	Second Harmonic Generation in Optical Fibers *** Same Report as Dr. Hillman **	Mojdeh Anderson
26	Transition State Analysis: Gluconolactone by MOPAC	Bradley Combs
27	Second Harmonic Generation in Optical Fibers *** Same Report as Dr. Hillman ***	Stephen McClain
28	Modeling of a Structure-Actuator System with Structure-Borne Reaction-Mass Actuators with Optimal Design of Passive Vibration Absorbers *** Same Report as Dr. Hung Vu ***	Hao Pham

Geophysics Laboratory

29	Adaptation of the Axisymmetric TASS Model for Hurricane Simulations	Pat Fitzpatrick
30	Estimating Characteristics of Chemical Explosions in New England and Eastern Kazakhstan Using Local and Regional Seismic Data *** Same Report as Dr. Alan Kafka ***	Matt Jacobson-Carroll
31	Final Summary of Research Effort *** 1988 Participant ***	Thomas Kimble
32	Comparative Analysis of Various Atmospheric Modelling Techniques	David Sanborn

Rome Air Development Center

33	Characterization of a Spatial Light Modulator for Optical Filtering	Scott Coffin
34	Adaptive Beamforming Software for the Digital Beam Steering Antenna	Randal Mandock
35	A Study of Interacting Tunneling Units with Possible Application to High Temperature Superconductors *** Same Report as Dr. Klein ***	Timothy Mavor
36	A Simplified Method of Determining Noise Parameters of High Frequency MESFET's	William Patience

Rome Air Development Center (continued)

37	Study of a Communication Receiver for Spread Spectrum Signals *** Same Report as Dr. Donald Ucci ***	Ernest Rho
38	A Computer for Temporal Frequency Spectrum of Vegetation Clutter Return *** Same Report as Dr. Jay Lee ***	Lynda Tomlinson
39	Neural Networks and Parallel Computation of Fourier Transforms	John Wagnon

Weapons Laboratory

40	An Experimental Protocol for Line-of-Sight Slewing, Optical Alignment of AFT Body Station Keeping Control Emulation *** Same Report as Dr. Thomas Dwyer ***	David Andreshak
41	Scattering of Elastic Waves in a Random Inhomogeneous Soil Media *** Same Report as Dr. Duane Sanders ***	Robert Bolton
42	Modeling the Response of Pressurized Composite Cylinders to Laser Damage *** Same Report as Dr. Harry Hogan ***	Stuart Harbert
43	An Experimental Protocol for Line-of-Sight Slewing, Optical Alignment of AFT Body Station Keeping Control Emulation *** Same Report as Dr. Thomas Dwyer ***	Toby Martin
44	GPS Time Synchronization	Walter McCarter
45	Preliminary Guidelines on Tunable Diode Laser Use	Mary Nickels

Volume II
Wright Research Development Center
Aero Propulsion Laboratory

46	A Study of Jc in High Tc Superconductors Using a Magnetic Induction Method	Fred Arnold
47	Design of an LDV Data Analysis System	Duane Daddis
48	Preparation of a Dump Combustor for IDA Measurements	Robert Gabruk

Aero Propulsion Laboratory (continued)

49	Flow Limitations in Micro Heat Pipes *** Same Report as Dr. Frank Gerner ***	Jon Longtin
50	Laser Induced Fluorescence Probe of CH Radical	John McCord
51	Examination and Application of a One Dimensional Thermionic Energy Converter (TEC) Code	Scott VanDam

Avionics Laboratory

52	Band Diagram Subroutine and Band Bending in the Spike Layer for the BICFET	John Bambery
53	Software Design Recovery: A Case Study	Eric Byrne
54	Toolbox for Image Processing using Distributed Computing *** Same Report as Dr. Larry Crum ***	Michael Costarella
55	Neural Networks and Machine Learning	Michael Findler
56	A Theoretical Resolution of Multiple Frequencies *** Same Report as Dr. Choate ***	Diana Major
57	An Implementation of an Objective Measure of Speech Intelligibility	Douglas Melton

Flight Dynamics Laboratory

58	Radiation Hypersonic Aerodynamics: Numerical Simulation of Hypersonic Flows Past Slender Wedges Near the Continuum Limit	John Baker
59	Validation Schemes for Accelerated Crazing Tests and X3D - A Finite Element Analysis Code	Kerry Christopher
60	Neural Networks and their Role in Visual Object Recognition *** Same Report as Augustus Morris ***	Nancy Faulkner
61	Damage in Graphite/Epoxy Plates Subjected to Low Velocity Impact (1988 Participant)	Bryan Foos

Flight Dynamics Laboratory (continued)

62	Strain Distribution in Composite Coupons in Tension *** Same Report as Dr. W. Wolfe ***	Bryan Foos
63	Control System Design Modeling	Genevieve Huston
64	Accessing the Computer Automated Design Database (CADDB) Through CADS- A Computer Aided Design System	Richard Swift

Materials Laboratory

65	Dislocations in Rene' N4+ with Respect to Orientation and Temperature	David Alden
66	An Approximate Analytical Solution of the Nonlinear Diffusion Equation and a Preliminary Investigation of Nonlinear Optics	Darwin Boyd
67	Investigation of the Thermomechanical Response of a Titanium Aluminide Metal Matrix Composite Using a Viscoplastic Constitutive Theory *** Same Report as Dr. James Sherwood ***	Marcia Boyle
68	Synthesis of Model Benzothiazoles	Charles Gray
69	State of the Art Sensors for In-Situ Monitoring of Composite Cure	Dean Hofmann
70	Data Reduction of Photoreflectance from Capped Aluminum Gallium Arsenide Structures	Neal Jahren
71	Scanning Tunneling Microscopy and and Ballistic-Electron-Emission Spectroscopy	Rex Ramsier
72	Evaluation of CR-SI Alloys for Aerospace Structural Applications *** Same Report as Dr. Joseph Newkirk ***	James Sago
73	An Intelligent Neural Model for Recognition of Input/Output Patterns for a Molecular Beam Epitaxy Process	George Tompkins
74	High Resolution Scanning Electron Microscopy of Pitch-Based Carbon Fiber (1988 Participant)	Deborah Vezie

Volume III
Human Systems Divisions Laboratories
Harry G. Armstrong Aerospace Medical Research Laboratory

75	Research into Semen Analysis as a Sensitive Indicator of Neurotoxicity	Rosemary Barbaro
76	The Metabolism of 2-Methylheptane in Fischer 344 Rats	J. Matthew Clemens
77	Harness Belt Task *** Same Report as Dr. Szucs ***	Vincent Dimiceli
78	A Study of Transport Delay Using an Aircraft Simulator: Pilot Study	Lawrence Fleischer
79	Maternal Transfer of Hexachlorobenzene in the Rat	Ellen Goldey
80	Effects of Data Error on Problem-Solving Heuristics *** Same Report as Dr. Bonnie Walker ***	David Harper
81	The Physiological Effects of Dobutamine on the Cardiovascular System	Deborah Hollenbach
82	Investigation of a Selspot II Molten Analysis System Response to Impact Conditions	Laura Pytel
83	Speech Coding and Feature Recognition with a Backpropagation Neural Network	Janet Slifka

Human Resources Laboratory

84	Career Progression in Air Force Enlisted Personnel: An Examination of Two Alternate Criterion Measures *** Same Report as Dr. David Woehr ***	John Butemeyer
85	Investigation of Color Appearance within Low Light Levels *** Same as Prof. Douglas Mandra (1988) ***	Patricia Cooper
86	Working Memory and Cognitive Structure *** Same as Dr. Kathryn Cochran ***	Alice Horton
87	Evaluation of Air-Intercept Performance: Observer Reliability Issues *** Same Report as Dr. Tomporowski ***	Royce Simpson
88	Integral Displays in Interactive Dynamic Environments	Mona Toms

Human Resources Laboratory (continued)

89	Software Development to Support Data Collection and Analysis of Cognitive Task Analysis Studies	Ronald Van Etten
90	An Evaluation of Stereoscopic 3D Computer Displays	John Williamson

Occupational and Environmental Health Laboratory

91	Biological Analysis of Three Ponds at Peterson AFB, Colorado Springs, CO *** Same Report as Dr. Zagursky ***	William Jefferson
92	Statistical Analyses of Data Pertaining to Ground Water Contamination and Laboratory Quality Control *** Same Report as Dr. Barbara Alvin ***	Lisa Newberg

School of Aerospace Medicine

93	Investigation of the Release of Glutamate and Dynorphin A(1-8) by Hippocampal Mossy Fiber Synaptosomes Through Chemical and Electrical Stimulation	Sudarkodi Alagarsamy
94	Investigation of Picosecond Pulses from a CW Q-Switched Active Mode-Locked Laser (1988 Participant)	John Barnaby
95	PCR Analysis and in situ Detection of Ureaplasma urealyticum and Microplasma hominis *** Same Report as Dr. DelVecchio ***	Paul Calvo
96	Glutamate Involvement in the Photic Entrainment of Activity Rhythms in Hamsters	Brian Davis
97	Magnetodetection by Animals	Dagmar Fertl
98	Cryopreserving Chlamydomonas reinhardtii at -70°C by the Two-step Cooling Method	George Kim
99	Statistical Models in Social Dynamics	Teresa Lee
100	A Research Opportunity at Brooks Air Force Base: A Multi-Faceted Experience	Cynthia Moorhead

School of Aerospace Medicine (continued)

101	System and Signal Analysis of VEP Data and Joystick Error Analysis *** Same Report as Dr. Longbotham ***	Lional Ramos
102	System and Signal Analysis of VEP Data and Joystick Error Analysis *** Same Report as Dr. Longbotham ***	Joseph Rea
103	PCR Analysis and in situ Detection of Ureaplasma urealyticum and Microplasma hominis *** Same Report as Dr. Delvecchio ***	Raymond Wolfe

Wilford Hall Medical Center

104	Dental Materials	Terrance Jorden
105	Temperature Effects on Erythrocyte Sedimentation Rates in Whole Blood and on Erythrocyte and Platelet Volumes *** Same Report as Dr. Drost-Hansen ***	John Lafferty
106	Collecting Data and Occurrence of AIDS-Related Symptoms: Longitudinal Study of HIV U.S. Air Force Personnel	Paula Mellon
107	Comparison of Thromboelastograpy (TEG) versus Standard Hematologic Parameters to Predict Hemmorhage after Cardiopulmonary Bypass (CPB)	John Salinas

APPENDIX III B

ABSTRACTS

ABSTRACTS
ARMAMENT LABORATORY

Laser Polarimeter Development

by

Randall R. Hodgson

Abstract

Steps were taken to reduce measurement and data processing errors associated with the laser polarimeter developed last year. An automatic alignment procedure was coded into the lab computer as well as error checking and compensation code. The measurement-taking programs were altered to allow averaging the intensities over 2 or 4 sets of 180 degrees. Beam wander error with a period of 360 degrees was reduced by the averaging process. Changes were made in the equipment configuration which resulted in reduced mechanical vibration of the optical system. Documentation for each of the software modules is provided.

Euler Solutions to Transonic Flow Past an Ogive-Cylinder Body With Wraparound Fins

by

William D. Newbold

ABSTRACT

Euler solutions for transonic flow past a tangent-ogive cylinder projectile with wraparound fin stabilizers have been computed at two angles of attack using multiblock grid networks. Two flow problems with a Mach number of 0.95 were considered at zero degree and two degrees angle of attack. These flow problems were also used in a grid refinement study to investigate the sensitivity of the flow field to grid resolution and the relative accuracy of the computed solutions. Results for both flow problems show good agreement between the computed results and the physics of the flow field. At zero degree angle of attack a weak shock is formed behind the nose of the projectile, and there is no flow field disturbance produced by the infinitely thin fins. A second shock wave spans between the fins on the top surface of the projectile when at two degrees angle of attack. Smaller shocks are also captured on the sides of the projectile, extending from the lower fins. The flow field solutions for the two degree angle of attack problem, using two different grids, show no perceivable difference, indicating relatively grid independent results.

OBSERVATIONS AND IMPROVEMENTS OF BALLISTIC STRESS ANALYSIS TECHNIQUES

by

Glenn M. Waguespack

ABSTRACT

In an attempt to predict and prevent structural failures in experimental projectiles during their initial accelerations, the Air Force Armament Laboratory at Eglin Air Force Base, Florida is incorporating various stress analysis programs into the Projectile Design Analysis System (PRODAS), a software package that performs various analyses to aid projectile designers. The main objective of this research was to incorporate a finite element stress analysis routine by Mr. Wafa Yazigi into PRODAS. While waiting for the completion of this proposed group of subroutines, I spent the first portion of this research period learning about PRODAS by modifying and debugging a conventional stress analysis routine written by Kurt Gothe. The FE routine was never written, so the objective shifted to studying and recommending different modeling and analysis techniques for performing an FE analysis on projectiles. The findings suggest that projectiles can be easily modeled by AXISYMMETRIC or 3-D elements, and a quasistatic analysis is sufficient to perform the analysis without solving the dynamic equations of motion.

ABSTRACTS
ARNOLD ENGINEERING AND DEVELOPMENT CENTER

DISTRIBUTED AND PARALLEL IMAGE AND SIGNAL PROCESSING

by

D. Mitchell Wilkes, Phd.

Ben A. Abbott

Lester E. Lynd, Jr.

Richard S. Souder

ABSTRACT

Automatic programming is used to develop parallel and real-time processing structures under the Multigraph Programming and Execution Environment (MPEE). The MPEE is a high level software development environment that uses AI techniques and graphic editors to model the signal flow within a signal processing system. This work forms the basis of this final report, and is already showing the feasibility of such tools to ease the generation of large-scale signal processing and image processing systems.

Latin Hyper-Cube Sampling with Regression Analysis for Prediction of Engine Infrared Observables

by

Darren Michael Allen

ABSTRACT

The Latin Hypercube Sampling (LHS) and Rank Regression codes from Sandia National Laboratories were ported to the IBM-PC to facilitate model development of jet turbine engine IR (Infrared) observables. A sample model was developed to illustrate the use of both programs and a step by step method developed for application to the actual engine data and/or model simulations produced by super-computer.

A New User Friendly Two Dimensional Plotting Program for the Cray Time Sharing System

by

Brian W. Bennett

ABSTRACT

The program was designed to make quick two dimensional plots using the graphics package DISSPLA. The program that was currently in use was not easily modified if anything other than a linear plot was desired. After talking with the group members about what changes they would like to see, these suggestions were incorporated into the new program. The program was written in FORTRAN 77 using structured programming techniques. A semi menu driven format was also employed. A final summary page of all parameters entered by the user is presented for a final confirmation before the plot is actually drawn. This allows for correction of any typographical errors.

MATRIX INVERSIONS ON CANDIDATE GEOMETRIES FOR APPLICATION OF CT EMISSION TECHNIQUES TO BROAD BAND RADIATIVE TRANSFER

by

Judy E. Dye

Abstract

This reports the effort undertaken to lay the groundwork for the application of the emission techniques of computed tomology to broad band radiative transfer for the determination of gas properties (temperature, pressure) of hot radiating gases at the interior of combustion flames and burners. Matrix inversion was done on several geometries with a first-order examination of sensitivity.

DISTRIBUTED AND PARALLEL IMAGE AND SIGNAL PROCESSING

by

D. Mitchell Wilkes, Phd.

Ben A. Abbott

Lester E. Lynd, Jr.

Richard S. Souder

ABSTRACT

Automatic programming is used to develop parallel and real-time processing structures under the Multigraph Programming and Execution Environment (MPEE). The MPEE is a high level software development environment that uses AI techniques and graphic editors to model the signal flow within a signal processing system. This work forms the basis of this final report, and is already showing the feasibility of such tools to ease the generation of large-scale signal processing and image processing systems.

A SURVEY OF THE PERSONAL COMPUTER ENVIRONMENT AT ARNOLD ENGINEERING DEVELOPMENT CENTER

by

Betty A. Pipes

ABSTRACT

There are approximately 700 personal computers (PC's) at AEDC. They are purchased by different companies for varying purposes and function with a variety of software. With the advent of more PC's in the workplace and a larger range of usages, their requirements become more visible and the nature of their strengths and weaknesses manifests itself in wider arenas. As a response to the needs of the PC community at AEDC, a Small Computer Support Committee is being formed. This committee will be an advocate for users' needs and concerns. Its mission will require a knowledge of the areas wherein resources can be constructively applied.

This report details my efforts to survey AEDC personal computer users and to define their environment with special attention toward the areas in which support can be best directed.

DISTRIBUTED AND PARALLEL IMAGE AND SIGNAL PROCESSING

by

D. Mitchell Wilkes, Phd.

Ben A. Abbott

Lester E. Lynd, Jr.

Richard S. Souder

ABSTRACT

Automatic programming is used to develop parallel and real-time processing structures under the Multigraph Programming and Execution Environment (MPEE). The MPEE is a high level software development environment that uses AI techniques and graphic editors to model the signal flow within a signal processing system. This work forms the basis of this final report, and is already showing the feasibility of such tools to ease the generation of large-scale signal processing and image processing systems.

A NONLINEAR FILTER AND AN ODD/EVEN ITERATION FOR INVISCID FLUID FLOW EQUATIONS

by

Robert W. Tramel

ABSTRACT

A nonlinear filter based on artificial dissipation is tested and shown to produce an effective shock capturing scheme for hyperbolic systems of conservation laws. In order to control spurious oscillations, the filter is applied after every time step to the difference solution from a locally implicit scheme for the Euler equation. The method is tested on both unsteady and steady test problems in order to demonstrate the efficacy of the technique. On steady flow problems, an odd/even grid ordering is considered. This ordering is shown to be robust and also well suited for implementation on vector computers.

ABSTRACTS
ASTRONAUTICS LABORATORY

THE EFFECTS OF ELEVATED TEMPERATURE EXPOSURE ON THE STRENGTH AND MICROSTRUCTURE OF 2-D CARBON-CARBON

by

Christopher G. Kocher

ABSTRACT

Results of an investigation into the effects of heat treatment on the strength and microstructure of 2-D CVD-matrix carbon-carbon are presented. Test specimens were heat treated to 1800°F, 2700°F, 3500°F, and 4500°F in an inert atmosphere. Tension, shear, and compression tests were performed to ascertain the effect of heat treatment on the strengths and moduli of the material. Microscopic evaluation was performed using optical microscopy to determine microstructural changes. Periodic edge replication was performed during some tests to examine the cumulative development of damage. Exposure to the highest temperature was shown to produce an approximately 25% decrease in tensile and shear strength. The compression data showed wide scatter and is inconclusive, though edge replication gave evidence as to the failure process in compression as well as in tension. It is determined that characteristic damage states are created that are dependent on the temperature of exposure but appear to be independent of the heating rate.

Vibration Control of a Cantilevered Beam Using a Distributed Actuator

by

David A. Lapioli

ABSTRACT

The dynamics and control aspects of a long, thin cantilevered beam were studied to model a component of a large flexible space structure. Experiments using piezoelectric film as a distributed actuator were conducted and the results were compared to computer simulation and to previous work done at the Charles Stark Draper Laboratory (CSDL). In the experiments, tip acceleration for a cantilevered beam with an initial tip deflection was measured. Various control laws (mainly "bang-bang" type) were applied to actuate the piezo-film, to try to find the vibration settling time. The partial differential equation and boundary conditions are presented for the cantilevered beam configuration and a solution is shown which results in the shape functions for the beam and the system model. The experimental methods and techniques for film application, data acquisition, etc. are described.

Patricia Liu

Using the STM to Characterize the Effects of Surface Treatments on the Surface Morphology of Carbon Fibers

Abstract

Proper adhesion between the fiber and the matrix is a necessary factor in achieving optimum performance of composite materials. Thus, a fundamental understanding of the microstructural changes at the fiber surface will provide guidance in developing a strong adhesion at the fiber-matrix interface . In order to achieve this goal, the microstructural changes that resulted from different fiber surface treatments were investigated by using a scanning tunnelling microscope.

Finite Element Model for ASTREX

by
Randy Trung Quy Nguyen

ABSTRACT

To control structure interaction of a big model as ASTREX, one needs to know the initial vibration frequencies of the model due to the gravitational and the thrust forces. This is in essence the project that I devoted my summer to completing. By generating the finite element model, NASTRAN, I came up with all the necessary data results that will help other researchers in the future to understand the concept of the model and make it easier for them to work further along in improving the technology. By using the initial vibrational frequencies of the model, one can see the deformation caused by the bending and movement of the system. These vibrational frequencies can also be used to control the model in rotation and translation to any desired position.

Modeling of Combustion Instability in Solid Rocket Motors

by Sonja C. Schillmoeller

ABSTRACT

Combustion instability is the result of interaction between the combustion processes associated with solid propellant burning in the combustion chamber of a rocket engine and pressure oscillations present within the gaseous phase of the combustion chamber. If this instability becomes too great, it may result in destruction with the final and unwanted outcome of the rocket engine being completely destroyed. Due to the common use of nonsmoke propellants (which are more susceptible to interactive effects) in tactical weaponry, the ability to predict the occurrence of instabilities is of high priority. Through the years, models have become more realistic in their computational efforts therefore enhancing the ability to better predict the onset of combustion instability. Efforts this summer were mainly concerned with enhancing nonsteady combustion modeling. Currently, nonsteady calculations are performed using the PEM (Petite Ensemble Method) which is not the most recent method of calculating solid propellant burn rates. Enhancement, therefore, consisted of performing nonsteady calculations using the COR (Continuous Oxidizer Regression) method, a more up-to-date method of calculating burn rates.

State Variable Control of a Flexible Grid Structure

by

Matthew L. Westerheide

Abstract

A finite element model for the structure was developed, tested, and verified. Nastran was used to develop this model in conjunction with a fortran program which calculated the A, B, C, and D matrices for the grid structure, from the Nastran output. A control scheme was then chosen, developed, and finally implemented via a MAX-100 computer.

ABSTRACTS
ELECTRONIC SYSTEMS DIVISION

CARRIER FREE RADAR

BY

BERYL L. BARBER

AND

KEITH CARROLL, DOUGLAS PEDERSON, GEORGE RAMLOW

Investigation is made into the short pulse radar. Many problems are covered and a look at definitions discussed. Solutions to some of the problems are offered. These investigations were confirmed experimentally.

Analysis of Testability Concepts and its Application to RSIP

by

Dr. S. Natarajan
and
Bradley K. Herman

ABSTRACT

Testability is becoming an increasingly important design consideration as systems continue to become more complex. In order to be effective, testability must be considered at the earliest possible point in the design phase. This will allow changes to be made to the design when it is still feasible to do so. The incorporation of testability must be done in a systematic manner to be effective. Verification of inherent testability must be done with the proper CAD testability analysis tool and the results should be applied back to the design to improve inherent testability.

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ABSTRACTS
ENGINEERING AND SERVICES CENTER

Effects of Jet Aircraft Noise on Domestic Goats

by

Jon D. Zern

ABSTRACT

Military jet aircraft operations cause unwanted noise pollution and have resulted in numerous complaints from the public. In an effort to deal with this problem, a research protocol was developed by the UES Summer Fellow to evaluate the altered physiology of goats exposed to noise from low-level jet aircraft. The graduate student researcher functioned as the principal assistant to the Summer Fellow in completing project goals. Before the experiment began, about 3-wk of the 10-wk stay at Tyndall AFB were devoted to dealing with processing requisitions, solving logistical problems, arranging for various kinds of project support, and constructing goat pens and shelters. Completion of all preliminary activities, including construction of pens and shelters, required about 4-wk. Baseline animal data collection began at the end of the third week. Collecting vital signs, blood samples, and behavioral observations covered a total of about 7 wk; 2-wk for baseline data and 5-wk for experimental data. Feeding, managing, evaluating, and assisting in project research provided the graduate student researcher a wide variety of meaningful experiences.

CONTAMINATE FLUX REDUCTION THOUGH IN SITU SOLUBILITY MODIFICATION

by
Kirk Hatfield and
Joseph Ziegler

ABSTRACT

Research was conducted to develop and test a bench-scale in situ groundwater pollutant partition system. A zone was created within a sand box aquifer where the porous medium had been treated with a decane/mineral oil solution to induce partitioning into the organic phase. Hydrophobic groundwater pollutants were intercepted within the partition zone as they migrated from the source. Contaminate flux reductions of 85 to 99.9 percent were observed in the laboratory. Chemical partition experiments indicate small systems (of 1 meter in length) could remove hydrophobic contaminates under natural hydraulic gradients for 5 to 8 years.

ABSTRACTS
FRANK J. SEILER RESEARCH LABORATORY

AN INVESTIGATION OF DYNAMIC STALL VORTEX CHARACTERISTICS

by

Julie A. Albertson and T.R. Troutt

ABSTRACT

This research investigation concentrated on expanding knowledge of the unsteady aerodynamics produced by pitching airfoils in uniform flows. The specific experimental situation focused on three distinct areas. A laser–Doppler–velocimetry system was assembled and aligned for use in a water tunnel. Preliminary verification tests show promise for accurate future velocity measurements. A separate flow visualization study involved a two–dimensional NACA 0015 airfoil pitched at constant rates through angles of attack from 0–50 degrees. The experimental results included 35 mm still and video camera flow visualization using dye. These tests showed it was possible to entrain dye within the center of the dynamic stall vortex if it was injected through the airfoil surface. This is a necessary step for any future image analysis or laser–Doppler–anemometry experiments on pitching airfoils in wind tunnels. The use of different colored dye injected at various airfoil locations also helped to clarify the mechanisms leading to dynamic stall, and shows great promise as a future flow visualization technique. A third part of the project involved a preliminary literature review of active control methods. It was determined that acoustic forcing, spanwise blowing, and an external oscillatory flap should yield the most effective control of dynamic stall flows.

SECOND HARMONIC GENERATION IN OPTICAL FIBERS

by

Lloyd W. Hillman, Stephen McClain, and Mojdeh Anderson

ABSTRACT

Second Harmonic Generation (SHG) is the partial conversion of light at one frequency (the fundamental) to light at twice that frequency (the second harmonic). Although unexpected, highly efficient (>5%) SHG occurs in Ge-P doped silica-core optical fibers. Österberg and Margulis first demonstrated SHG at 532 nm using 1064 nm light from a mode-locked Q-switched Nd:YAG laser. Our goal was to investigate SHG in optical fibers starting with visible light at 514 nm and generating near uv-light at 257 nm. We report our failure to observe such conversion and on our subsequent investigation on the generation of sub-harmonic light.

Transition State Analysis: Gluconolactone by MOPAC

by

Brad S Combs

ABSTRACT

MNDO and MNDO/PM3 transition states for the non-enzymatic hydrolysis of 1,5-gluconolactone and 6-deoxy-6-fluoro-1,5-gluconolactone are presented. Initial results indicate that hydrolysis at Carbon 1 (carbonyl carbon) proceeds with a lower heat of formation than hydrolysis at Carbon 5. Optimized geometries for associated products and reactants (MNDO and MNDO/PM3) are also reported. The synthetic routes for 6-deoxy-6-fluoro-β-D-glucose and 6-deoxy-6-fluoro-1,5-gluconolactone (chemical probes suitable for NMR work) are described. The results from this study provides useful information concerning the mechanism of hydrolysis of 1,5-gluconolactone.

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Modeling of a Structure-Actuator System with Structure-Borne Reaction-Mass Actuators and Optimal Design of Passive Vibration Absorbers

Prof. Hung Vu and Hao Pham, Graduate student

ABSTRACT

A structure–control system, which possesses dynamic characteristics of large space structure (LSS), was built. The system consists of a beam structure whose first two natural frequencies in bending and torsional modes are low (near 5 Hz) and two structure–borne reaction mass actuators (RMA). The system is modeled and analyzed using finite–element method (FEM) and NASTRAN. Optimal design of passive vibration absorber (PVA) is developed with the aid of $MATRIX_x$. The optimal PVA is designed by applying, with appropriate modifications, the classical formulas of optimal tuning and damping[1,2,3] with the absorber tuned to the lowest structure resonance.

ABSTRACTS
GEOPHYSICS LABORATORY

Adaptation of the Axisymmetric TASS Model for Hurricane Simulations

by

Pat Fitzpatrick

ABSTRACT

In the numerical modelling of tropical cyclones, one may utilize a three dimensional version for real case studies, or utilize an axisymmetric version to study the physical and dynamical processes, despite their lack of realism. Usually the latter is chosen for computational purposes. Furthermore, the nonhydrostatic models with ice microphysics currently represent the hurricane's interactions best. The goal of the study was to develop a scheme that would incorporate a nonhydrostatic domain near the center of the tropical cyclone, and superimpose it on a larger scale, hydrostatic domain that includes the outer fringes of the storm. The Terminal Area Systems Simulator (TASS) model, a nonhydrostatic, compressible computer program complete with ice microphysics, was chosen for the study, since it simulates winds and physical processes of cumulus convection reasonably well.

Most of the research was focused on altering TASS so that it could simulate a hurricane eyewall. The main features that needed changing were some microphysical parameters, the boundary layer fluxes from the sea, and the initialization procedure for the genesis of the tropical cyclone. The fluxes were computed using aerodynamic bulk formulas, and the formation mechanisms included installation of a region of low-level vorticity, sea temperature, a convectively unstable lapse rate, and a moist mid-layer. Furthermore, the model's scaling assumptions needed altering, and this aspect of the research is still taking place. The implications of the research are that hydrostatic and nonhydrostatic interactions can be investigated, and that the development of this type of model may reduce the high computation time currently required for these models.

Estimating Characteristics of Chemical Explosions in New England and Eastern Kazakhstan Using Local and Regional Seismic Data

by

Alan L. Kafka
and
Matthew Jacobson-Carroll

ABSTRACT

One of the problems associated with monitoring a comprehensive nuclear test ban treaty is that of discriminating between small explosions and earthquakes based on seismic data. Chemical explosions are used routinely in the mining and construction industries in both the United States and the Soviet Union. These chemical explosions usually occur at very shallow depths (a few tens of feet), and probably are all shallower than a few hundered meters. Most nuclear explosions are detonated at depths of less than about one kilometer, and the deepest underground nuclear explosions are a few kilometers deep. On the other hand, most earthquakes occur deeper in the earth's crust. Thus, accurate estimation of the depths of seismic sources can be helpful in discriminating earthquakes from explosions. During the past several years, the Principal Investigator (PI) for this summer project has been studying the use of short-period Rayleigh waves (Rg) as a depth discriminant for seismic sources in New England. The research that we conducted this summer was primarily an extension of the PI's research on Rg as a depth discriminant. In addition, we investigated other aspects of estimating characteristics of chemical explosions from local and regional seismic data. The primary goal of our research this summer was to record seismic data at field sites located at near-regional distances from quarry blasts.

Mr. Thomas Kimble
1988 Graduate Student Participant
No Abstract Submitted

Comparative Analysis of Various Atmospheric Modelling Techniques

by

David C. Sanborn

ABSTRACT

A comparative analysis of various atmospheric models developed by international and national bodies such as the International Council of Scientific Unions (ICSU), Committee on Space Research (COSPAR), the Geophysics Laboratory (GL) of the United States Air Force Systems Command, and the Middle Atmospheric Program (MAP) was done over the summer of 1989. Existing models of the atmosphere from various sources specify properties from data sets obtained from different platforms (rockets,satellites, and balloons). There are also variabilities such as those due to latitude, longitude, and time of day/year to be considered.

ABSTRACTS
ROME AIR DEVELOPMENT CENTER

Characterization Of A Spatial Light Modulator For Optical Filtering

by

Scott W. Coffin

ABSTRACT

The Semetex Sight-Mod spatial light modulators offer the possibility of real time optical filtering capabilities. Here a 128x128 Semetex Sight-Mod spatial light modulator (SLM) is viewed with an eye toward phase-only correlation filtering. Computer software was developed to allow graphics drawn on a computer drawing program to be displayed on the SLM. These frames can then be chained into multiple frame files for sequential display. This software was developed to aid in characterization of the Sight-Mod device and for use in its operation in a filter set up. Then several important characteristics of the device are both predicted and measured, the results of which are given in this report.

ADAPTIVE BEAMFORMING SOFTWARE FOR THE DIGITAL BEAM STEERING ANTENNA

by

Randal L. N. Mandock

ABSTRACT

Theoretical beam patterns were investigated with conventional and adaptive nulling models. The Applebaum adaptive beamforming algorithm was used to study the effects of random system errors and of strong interference sources located within the half-power beamwidth of the main beam. Figures 1 through 8 show that increasing the level of element channel errors results in beam broadening, beam squint, increasing sidelobe levels, and the filling in of nulls. Figures 9 through 15 illustrate the change in Applebaum pattern produced by varying the look angle in the absence of element channel errors. For look angles greater than one-half the half-power beamwidth, the effect of the jammer is barely recognized on the main lobe and the adaptive pattern is well-behaved. Within the half-power beamwidth the nulling algorithm splits the main beam and is essentially ineffective for jammers located there. As shown by Figures 16 through 22, the same conclusions are derived with inclusion of real system errors.

A Study of Interacting Tunneling Units with Possible Application to High Temperature Superconductors

Dr. Michael Klein and Timothy Mavor, Graduate Student

ABSTRACT

Most amorphous and glassy materials exhibit anomalies in their low temperature thermal properties. Very similar anomalies were observed in a number of high temperature superconductors. Whereas it is believed that these anomalies arise from the presence of tunneling states in the solid, so far there is no microscopic model for these tunneling states. Recently I examined a system of tunneling dipoles distributed in alkali halides and found that they give glasslike properties at low temperatures. Thus dilute tunneling dipoles present a microscopic model for glasslike properties. The purpose of this research to derive the thermal properties of dilute quadrupoles and examine whether they can explain the temperature-dependent variation of the sound velocity of some high T_c superconductors.

A Simplified Method of Determining Noise Parameters of High Frequency MESFET's

by

William Patience

ABSTRACT

Using established circuit analysis techniques and linear, noisy two-port theory, an expression for noise figure is derived. S-parameter and noise figure measurements are taken over appropriate frequency ranges at a constant source impedance and used to determine all unknown parameters in the noise figure expression. At a particular operating frequency, noise figure is now expressible in terms of a single variable, source impedance. The procedure outlined by Lane [1] can be readily applied, with no additional measurements required.

Study of a Communication Receiver for Spread Spectrum Signals

by

Donald R. Ucci & Ernest Rho

ABSTRACT

A simulation of a Frequency Domain Receiver (FDR) was ported from an IBM-type Personal Computer to a Commodore Amiga Multi-tasking Personal Computer System. The enhanced speed and graphics capability of the Amiga was exploited. This system will serve as a workstation for testing communication systems of the future at RADC.

A simulation of an Adaptive Nonlinear Coherent Processor (ANCP) was performed. The signalling environment was presumed to have present non-Gaussian interferers. It is known that, when the received signal contains highly non-Gaussian components, a receiver based on the likelihood function shows substantial performance improvement over correlation processing. This nonlinear demodulator requires the learning of the interference Probability Density Function (PDF) and subsequent generation of an appropriate nonlinear function. In this study a histogram approach was used for estimation of the PDF and the nonlinearity was generated from this estimate.

Several problems were revealed during software simulation. These included PDF estimation at singular points, appropriate smoothing for the histogram and determination of the optimal number of samples and bins for the PDF histogram.

A Computer Model for Temporal Frequency Spectrum of Vegetation Clutter Return

by

Jay K. Lee and Lynda Tomlinson

ABSTRACT

A computer model that incorporates polarization information is developed for predicting the temporal frequency spectrum of the clutter return from forest vegetation at C-band and S-band based on the geometric and physical parameters of the vegetation.

It is assumed at these frequencies the predominant backscattering occurs from leaves in the forest canopy. A multiple scattering model that incorporates vegetation density, moisture content of leaves and correlation lengths as adjustable parameters is used to calculate the radar cross section of the stationary canopy for both horizontal and vertical polarization.

The temporal frequency spectrum of the backscattered radiation is estimated under windy conditions, by assuming the leaf velocity in the direction of incident radiation is described by a quasi-harmonic oscillation.

The effect of adjustable parameters on the resulting spectrum is anaylzed.

NEURAL NETWORKS AND PARALLEL COMPUTATION OF FOURIER TRANSFORMS

by John Wagnon

Summer Graduate Fellow RADC/IRRA

Abstract

Computation of the Fourier Transform is a very common preprocessing scheme in signal processing systems. An implementation of the Discrete Fourier Transform based on neural network design principles would take advantage of the networks analog behavior and massive parallelism to compute the transform in times one would expect to be orders of magnitude faster than most conventional implementations. This paper examines a neural design based on the error backpropagation training rule, two based upon Hopfield network design principles, and a final, direct form, design based intuitively on the definition of the Discrete Fourier Transform. Only the last two designs are deemed satisfactory upon close examination and recommendations are made for comparing them. Finally, this research clearly illustrates that not every problem is suitable for a neural network solution.

ABSTRACTS
WEAPONS LABORATORY

AN EXPERIMENTAL PROTOCAL FOR LINE-OF-SIGHT SLEWING. OPTICAL ALIGNMENT AND AFT BODY STATION KEEPING CONTROL EMULATION

by

Thomas A. W. Dwyer, III
David S. Andreshak
Toby B. Martin

ABSTRACT

This report records the results of an evaluation of the capability of the TACOS pointing and tracking test bed at WL/ARCD for directed energy weapon or space telescope slewing, optical alignment and aft body station keeping control emulation, as well as the adaptation thereto of appropriate parameter estimation and control procedures.

SCATTERING OF ELASTIC WAVES IN A RANDOM INHOMOGENEOUS SOIL MEDIA

by

Duane R. Sanders

and

Robert W. Bolton

ABSTRACT

A literature survey of wave scattering models applicable to random homogeneous soil media was performed. From the literature review the Kramers-Kronig method for calculating the dispersion in a random inhomogeneous media was selected. The Kramers-Kronig method was implemented into a plane wave computer code and a parameter study was performed in which the scatterer size, scatterer concentration, and elastic constants for the scatterer and matrix were varied for a range of values typical of the McCormick Ranch, Albuquerque, NM. It was determined that the Kramers-Kronig method was able to model the variability in acceleration spectra recorded at the McCormick Ranch due to a buried detonation for different azimuthal directions by considering: different combinations of scatterer size, scatterer concentration, elastic constants of scatterer and matrix and Q that are typical of the variability of these parameters in different azimuthal directions at the McCormick Ranch. The results of the study indicate that the Kramers-Kronig method does have application in modeling the wave propagation characteristics in a random inhomogeneous media.

MODELING THE RESPONSE OF PRESSURIZED COMPOSITE CYLINDERS TO LASER DAMAGE

by

Harry A. Hogan
and
Stuart J. Harbert

ABSTRACT

The response of pressurized composite cylinders to laser damage is a problem of interest to the Air Force and the Weapons Lab because of its application to the Strategic Defense Initiative. Current numerical models for this problem, however, are generally inadequate to allow predictions outside the range of parameters for which a large experimental database already exists. Thus, the advantages of modeling cannot be fully exploited. In an effort to develop an improved model that includes more basic mechanisms and first principles, several related tasks were undertaken. First, current models and experimental test results were evaluated and studied in order to gain as comprehensive an understanding of the problem as possible. In addition, the broader composite materials research literature was searched and reviewed in an effort to establish the current state of the art in areas closely related to the problem at hand. The two topics focussed upon were delamination at free edges and failure analysis and prediction for laminates with holes or notches. Finally, preliminary modeling activity was initiated at WL/TALE using in-house software and hardware. Short-term recommendations for improved modeling center on evaluating the effects of delamination on critical stress states near the damage site and implementing more advanced failure criteria for predicting laminate rupture.

AN EXPERIMENTAL PROTOCAL FOR LINE-OF-SIGHT SLEWING, OPTICAL ALIGNMENT AND AFT BODY STATION KEEPING CONTROL EMULATION

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David S. Andreshak
Toby B. Martin

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This report records the results of an evaluation of the capability of the TACOS pointing and tracking test bed at WL/ARCD for directed energy weapon or space telescope slewing, optical alignment and aft body station keeping control emulation, as well as the adaptation thereto of appropriate parameter estimation and control procedures.

GPS TIME SYNCHRONIZATION

by

Walter Cyrus McCarter

ABSTRACT

Precise global clock synchronization is an integral part of the Global Positioning System (GPS) operations. The GPS satellites' clocks are moving with respect to the clocks of the surface stations observers at speeds sufficient to necessitate careful consideration of special relativistic effects on the synchronization of the clocks. At the same time, the GPS satellite orbit radii are large enough to cause a sufficient difference between gravitational potentials at the satellite clocks and at the surface station clocks to produce an effect on the clocks synchronization of the same order of magnitude as the special relativistic effects. A consistent treatment of both effects can be done only in general relativity.

We have performed a general relativistic analysis of the GPS time transfer effects. The expressions obtained for the effects admit an unambiguous physical interpretation of each term, which clarifies the physical origin of effects.

PRELIMINARY GUIDELINES ON TUNABLE DIODE LASER USE

By

Mary Jane Nickels

ABSTRACT

Tunable diode lasers are state-of-the-art technology. This final report encompasses the progress made in getting this instrument operational and guidelines for operating this instrument.

ABSTRACTS
AERO PROPULSION LABORATORY

A Study of Jc in High Tc Superconductors Using a Magnetic Induction Method

by

Fred Arnold

Abstract

When a high Tc superconductor is cooled below its transition temperature, its resistance drops essentially to zero. By using a non-contact method in studying the electrical properties of these ceramic superconductors, we can avoid the large contact resistance associated with a probe method. The critical current density (Jc) of a material is a measure of how well it can transport current. A magnetic induction method will be used to determine Jc. Jc will be measured at 4K and at 77K. The dependence of Jc on the cross sectional area of the specimen will also be determined as well as the effect of adding silver (Ag) to the 1-2-3 ($YBa_2Cu_3O_{7-x}$) material.

DESIGN OF AN LDV DATA ANALYSIS SYSTEM

by

Duane Daddis

ABSTRACT

The bulk of this report is a users guide and technical reference manual for a data analysis system. This system was developed in order to extract useful information from raw LDV data. This report deals specifically with the structure of the analysis system. A theoretical description of the methods used in the analysis can be found in the final report "Large Scale Motion and Coherent Structures In Axisymmetric Swirling Flow of a Dump Combustor", written by B. Lieber.

The first section of the manual provides the user with a quick reference for operating the analysis package. This section contains the the information necessary to obtain a power spectra of the velocity field in predetermined points.

The second section provides a detailed technical description of the analysis package. The methods used in the computer codes that make up the system are also described.

Preparation of a Dump Combustor for LDA Measurements

by

Robert S. Gabruk

ABSTRACT

To examine the effects of combustion on the flowfield of a ramjet engine, a water-cooled, stainless steel dump combustor model was developed. Two main goals had to be met before any flowfield data could be obtained. First of all, the combustor had to be configured to operate in an acceptably stable mode. Stability was identified by the pressure spectra obtained under various running conditions using piezoelectric pressure transducers wired to a spectrum analyzer. Operational parameters such as fuel composition, fuel injection location, acoustic configuration, and equivalence ratio were varied until instabilities were minimized. The optimal configuration ran with upstream fuel injection (premixed mode) with propane as the fuel. Injection occurred near the centerline of the inlet duct with an equivalence ratio of 0.65. An orifice plate was installed to change the acoustic character of the duct and to enhance fuel-air mixing.

After the combustor was configured to run in an acceptable mode of operation, the data acquisition system (NEFF 470) was updated as to correctly measure and calculate inlet and combustion conditions. Furthermore, a user's help manual was writtem to simplify the process of learning the system.

FLOW LIMITATIONS IN MICRO HEAT PIPES

F.M. Gerner and J.P. Longtin

ABSTRACT

This paper examines the basic physics governing operation of micro heat pipes. It also explores the operating limits which will determine the maximum heat transfer capability of these devices. These devices, which utilize latent energy to transport thermal energy at very uniform temperatures, will be extremely useful for dissipating the large heat fluxes expected in the next generation of computers.

A simple analytic model is shown to predict the operating limit for 1 mm hydraulic diameter devices. This model is then used to show the expected effectiveness for 100 μm hydraulic diameter devices currently being built. Not only is the expected heat flux large, 10 - 15 W / cm^2, the temperature drop should be very small, of order $0.01^{o}C$.

LASER INDUCED FLUORESCENCE OF CH RADICAL

by

John E. McCord

ABSTRACT

The capability for laser excited fluorescence detection of radical species (primarily CH) has been developed for Dr. Peter Bletzinger's laboratory in room D-103, building 450 at Wright-Patterson AFB. It is intended that this technique be used to measure diffusion and loss rates of deposited radicals in frozen rare gas matrices at various matrix temperatures.

Examination and Application of a One Dimensional Thermionic Energy Converter (TEC) Code

by

Scott A. VanDam

ABSTRACT

A one dimensional thermionic energy converter computer code was examined and utilized to provide a theoretical basis of comparison for experimentally derived data obtained from a lanthanum-hexaboride (LaB_6) cesium vapor thermionic diode. Although the code-generated characteristics were not in precise agreement with the experimental results, they do provide a basis for establishing the validity of the experimental data from an analytical framework. Certain discrepancies were thus identified and attempted to be accounted for in terms of possible code inadequacies and/or experimental error.

Auxiliary programs were written and used in conjunction with the original TEC code to generate both general and simulated LaB_6 diode current density vs. output voltage (J-V) characteristics. The effects of changing the emitter and collector work functions, as well as the operating cesium vapor pressure, were investigated for both cases. The results are displayed and analyzed in terms of their respective J-V characteristic curves.

ABSTRACTS
AVIONICS LABORATORY

Band Diagram Subroutine and Band Bending in the Spike Layer for the BICFET

by

John Bambery

ABSTRACT

The BAND subroutine was added to the analytical program for the BICFET so that one may visualize the band structure of the device.

The GAASEQ subroutine was modified to take into account the band bending which occurs in the highly doped spike layer under equillibrium conditions. The structure of GAASEQ was modified to accomodate changes more easily, while still solving the charge balance equation through the use of a bisection routine.

Software Design Recovery: A Case Study

by

Eric J. Byrne

ABSTRACT

The "dusty deck" problem refers to old programs that are still useful. Such programs usually are undocumented, difficult to understand, maintain, and/or modify. There exists a large body of software that could benefit by being re-structured and/or rewritten using modern techniques and programming languages. Computer aided software engineering (CASE) tools promise to help in the development and maintenance of new software, but often are not helpful with older software. Many CASE tools for design and development can not work with software not initially developed using these tools. A solution is to recover the design of older software and record it in a CASE environment. This allows older programs to be re-developed using modern structured techniques. The result is that useful software is given new life, is better structured, well documented, and easier to maintain. This paper reports on a design recovery effort and the experiences gained.

Toolbox for Image Processing using Distributed Computing

Prof. Larry Crum and Graduate Student Michael Costarella

Abstract

Introduction

Present learning algorithms are highly computation intensive. Requirements for computer time severly limits practical application. Whereas computers can be expected to significantly improve in speed, speed increases alone cannot provide the orders of magnitude increases needed. Highly parallel computation will be necessary to render learning as a practical reality in systems. Transputers provide the most reasonable environment to study and develop new high speed alternatives.

The summer program provided an opportunity to be introduced to transputer networks and physical options for their usage, programming in OCCAM II and in higher level languages which have translators to OCCAM II, tools which are becoming available to develop and implement transputer algorithms, and some perspective on present applications of transputers. A variety of well-known image processing algorithms was viewed in terms of effective implementation on transputers. Initial work on a set of tools for Image processing was begun.

Focus

The focus of our research is to consider aspects of data distribution throughout various topologies of transputer networks. Hopefully methods suitable for use in the implementation of a collection of "parallel" image processing algorithms can be developed. These will be combined with a number of other software subsystems to create an adaptive vision system built on transputer technology.

Research commensed with familiarization with transputer architecture and programming environments. An appropriate data structure for image representation was investigated. The image processing algorithms complementation, convolution, filtering, and histogram measurement and modification were reviewed in terms of abilities to implement using the data structure.

Neural Networks and Machine Learning

by

Michael J. Findler

ABSTRACT

Survey of machine learning literature, with emphasis on pattern based learning techniques. Expert systems are reviewed and discarded as being too "brittle." Then adaptive systems are reviewed. Different assumptions are examined and current learning models are reviewed. Neural networks are contrasted to expert rule-based systems. Some of the advantages and disadvantages of neural networks are described. Finally, we present a light overview of Gail Carpenter and Stephen Grossberg's Adaptive Resonance Theory (ART) neural network topology.

THEORETICAL RESOLUTION OF MULTIPLE FREQUENCIES

by

David Choate

and Diana Major

ABSTRACT

An algorithm is developed to pair multiple frequencies with their residues modulo IFM receiver bandwidths. If these residues are distinct within each receiver and the number of these receivers exceeds the number of frequencies, then this pairing is perfect; that is to say, spurious frequencies can never arise. These conditions are shown to be the best possible. A suggestion is made on how to control noise.

An Implementation of an Objective

Measure of Speech Intelligibility

by

Douglas E. Melton

ABSTRACT

A method of calculating the Speech Transmission Index (STI) was implemented in software to measure the intelligibility over a voice communication system. A FORTRAN program was developed to generate speech-like test signals that replace speech sources in a voice communication system. The STI is evaluated at the receiver by a second program. The speech intelligibility measurement system was tested using test signals that had been corrupted by stationary bandlimited noise at various signal to noise ratios. Appropriate signal to noise ratios were first determined from informal listening tests.

ABSTRACTS
FLIGHT DYNAMICS LABORATORY

Radiation Hypersonic Aerodynamics: Numerical Simulation of Hypersonic Flows Past Slender Wedges Near the Continuum Limit

by

John Baker

ABSTRACT

A survey of literature dealing with hypersonic flows, numerical techniques for describing hypersonic flows, radiative transfer, and approximations to the Radiative Transfer Equation is presented. The problem of hypersonic flow in a slightly rarefied medium past a slender wedge is formulated using an explicit MacCormack finite difference scheme, the Navier-Stokes equations, and the Maxwellian velocity slip and temperature jump boundary conditions. Preliminary results are presented for the no slip case of a 2^{o} half-angle wedge. No conclusions are drawn since the research effort is still in the initial stages of finding convergent (steady-state) solutions of the Navier-Stokes equations for slightly rarefied flow past slender wedges.

VALIDATION SCHEMES

FOR

ACCELERATED CRAZING TESTS

AND

X3D - A FINITE ELEMENT ANALYSIS CODE

by

Kerry D. Christopher

ABSTRACT

Aircraft transparency durability is a principle concern of the Vehicle Subsystems Division and efforts are being made to increase the service life of these components. Transparency durability encompasses a range of issues from impact resistance due to birdstrike to optical degradation due to environmental exposure. A durability validation plan is being developed which will enable prediction of the service life of a transparency design based on tests of the building materials at the fabrication stage.

Resistance to birdstrike is considered during the initial design phases. One of the current finite element design analysis tools is MAGNA, Materially And Geometrically Nonlinear Analysis, which uses implicit integration methods. A new finite element analysis tool, X3D, based on explicit integration methods has been delivered to the Aircrew Enclosures Group for evaluation.

Failure modes that necessitate the rejection of the transparencies include scratches, cracks, crazing, coating deterioration and delaminations. The long term service life validation scheme will consider acrylic crazing because it is the predominate failure mode in transparencies. The F-16 transparency was chosen because of the large amount of data on hand associated with F-16 transparency failures. Once a successful scheme has been devised, additional schemes will be devised for other failure modes of various aircraft transparency systems.

Neural Networks and their Role in Visual Object Recognition

by

Augustus Morris, Jr., Ph.D.
and Nancy Faulkner

ABSTRACT

This work effort primarily explored the use of neural networks for object recognition. A compilation of institutions and companies doing work in this field was completed so that expert advice could be sought during the lab's development of neural network technology. Through the use of neural network development software, a preliminary network was designed to recognize simple geometrical shapes. Moments were used as features in the classification. Results were encouraging enough to pursue further development of this area.

DAMAGE IN GRAPHITE/EPOXY PLATES SUBJECTED TO LOW VELOCITY IMPACT (1988)

by_

Bryan C. Foos

ABSTRACT

Instrumented impact tests on laminated graphite/epoxy panels were conducted using a drop tower. The velocity of the impactor and the load time history were recorded for each specimen tested. In several tests, strains were measured on the back face during the impact event. The depth of surface indentation and the extent of internal damage were measured and correlated with the impact energy. Predicted strains in the outermost ply were compared with experimentally obtained values measured both perpendicular to and in the direction of the outermost fiber. The amount of internal damage and the indententation were found to be dependent upon the energy at impact and to a somewhat lesser degree on the velocity of the impactor. The shape of the damaged area in the specimens tested, was largely dependent upon the thickness of the panel and the location of the supports.

(1989)

STRAIN DISTRIBUTION IN COMPOSITE COUPONS IN TENSION

by

William E. Wolfe

Bryan Foos

ABSTRACT

An accurate measurement of tensile strength of graphite/epoxy composites can be difficult due to non-uniformities in the stress field, particularly in the area where the load is applied. The typical design of a tensile test coupon includes a fiberglass tab which is gripped by the loading machine and bonded to the composite specimen. A finite element study of the effect of tab geometry on the distribution of stresses and strains in tensile coupons was performed. The results of the analysis indicate that the strains in the specimen near the tab line are related to the angle the tab makes with the axis of the coupon and to the ply orientation. It was observed that the strain state in the coupon is less uniform when the tab line perpendicular to the long axis of the coupon than when the tab line is inclined.

Control System Design Modeling

by

Genevieve A. Huston

ABSTRACT

Accomplishments during the summer research period include learning to construct modal models from finite element data, and studying and practicing residue comparison model reduction techniques. Wright Patterson Flight Dynamics Laboratory has a 12 meter truss which is to be equipped with actuators and sensors for an active control experiment. When this test is completed, data will be collected and used to develop a model. Also during the research period, modal analysis tests were conducted on a radome and F-15 tail section, in order to allow a finite element model to be developed and dynamic characteristics to be studied. In addition, a control circuit was designed and built which will adjust current to a solenoid used for a zero gravity test of the truss.

Accessing the Computer Automated Design Database (CADDB) Through CADS - A Computer Aided Design System

by

Richard A. Swift

ABSTRACT

CADDB (the Computer Automated Design Database) allows a flexible environment for the retrieval and manipulation of ASTROS (the Automated Structural Optimization System) database information. There are currently a limited number of software packages which can directly access this database information. CADS (a Computer Aided Design System), which is used regularly for the pre- and post-processing of NASTRAN, ANALYZE, and OPSTAT analyses, was chosen for use with CADDB. It was desired to enhance CADS so that it could read data from CADDB. This would allow for the plotting and manipulation of the ASTROS finite element and aerodynamic models, as well as allowing for the post-processing of specific ASTROS analysis results (i.e., displacement, stress, etc.).

ABSTRACTS
MATERIALS LABORATORY

Dislocations in René N4+ with Respect to Orientation and Temperature

by

David Allen Alden

ABSTRACT

Oriented single crystals of the nickel-base superalloy René N4+ which had been mechanically tested in tensile and double-tensile tests were examined in a transmission electron microscope in an attempt to correlate mechanical response and dislocation type. The crystals had strikingly different mechanical responses with respect to orientation and temperature, and it was found that they existed quite different dislocation types as well, which correlated well with each other.

AN APPROXIMATE ANALYTICAL SOLUTION OF THE NONLINEAR DIFFUSION EQUATION AND A PRELIMINARY INVESTIGATION OF NONLINEAR OPTICS

by

Darwin L. Boyd

ABSTRACT

An approximate analytical solution of the nonlinear diffusion equation was applied to two special cases of concentration dependence of diffusivity. Zeroth and first order corrected dopant profiles were calculated for the cases $D = D_v C^v$ and $D = D_e \exp(kC)$. Good agreement was found between the first order corrected profiles and profiles obtained by a direct numerical integration using a forward time centered space differencing of the nonlinear diffusion equation. Additional work on the analytical solution produced results that allowed the initial dopant peak position and concentration at the surface to be accurately specified. These results would be essential to actual use of the analytical solution in tracking dopant profiles. Finally a preliminary investigation was made into nonlinear optics concentrating on surface electromagnetic waves at a plane boundary between $BaTiO_3$ and other optical materials.

INVESTIGATION OF THE THERMOMECHANICAL RESPONSE OF A TITANIUM ALUMINIDE METAL MATRIX COMPOSITE USING A VISCOPLASTIC CONSTITUTIVE THEORY

by

James A. Sherwood

Marcia J. Boyle

ABSTRACT

A research program has been initiated to investigate the stress distribution in a fiber-reinforced metal matrix composite resulting from thermomechanical loads. A detailed three-dimensional finite-element model of a unit cell of the composite was generated for evaluation via the ADINA finite-element code using the ADINA-IN preprocessor. Investigations of the thermomechanical response have been initiated using a classical temperature-dependent bilinear elastoplastic material model and a temperature-dependent viscoplastic unified state variable theory which includes drag stress and back stress state variables.

SNTHESIS OF MODEL BENZOTHIAZOLES

by

Charles E. Gray

ABSTRACT

Two benzothiazole models were prepared. The first model was prepared by reacting DABT monomer with 2-(1-propanesulfonicacidbenzimidazole) benzoic acid in polyphosphoric acid to give the corresponding 2,5-disubstituted dibenzothiazole. This model was prepared to determine stability of the monomer at polymer reaction conditions. The second model was prepared by reacting DABT monomer with formic acid neat. The resulting unsubstituted dibenzothiazole will be used to study non -linear optical properties of polybenzothiazoles.

State of the Art Sensors for In-Situ Monitoring of Composite Cure

by

Dean R. Hofmann

ABSTRACT

This paper surveys those sensors presently in commercial use or under development for the application toward in-situ composite cure monitoring. Five categories of in-situ sensors are presented: electrical properties, acoustic, optical, eddy current and direct. Theory and practice are discussed and a critical review of those sensors which are standard, hardened and currently used in industry is presented.

DATA REDUCTION OF PHOTOREFLECTANCE FROM CAPPED ALUMINUM GALLIUM ARSINIDE STRUCTURES

by

Neal Jahren

ABSTRACT

Photoreflectance is used to estimate the composition and doping levels of $Al_xGa_{1-x}As$ epilayers capped with GaAs. We have analyzed data from our experiment by fitting it with Aspnes' third derivative functional form and electro-optic function. We have also used an indirect method developed by Bottka et al. to estimate doping levels.

SCANNING TUNNELING MICROSCOPY AND BALLISTIC-ELECTRON-EMISSION SPECTROSCOPY

by

Rex D. Ramsier

ABSTRACT

A scanning tunneling microscope from the Department of Physics at The University of Akron has been configured to image surfaces and Schottky-barrier heterostructures of electronic devices fabricated in the Materials Laboratory of Wright-Patterson AFB. Computer code has been written in Microsoft C for: a) adjusting the tip-sample distance, b) acquiring data for topographic images of surfaces, c) acquiring ballistic-electron-emission spectra, and d) data processing for image enhancement. Electronic circuits have been designed and fabricated for: a) obtaining images of metal and semiconductor surfaces at constant tunneling current, and b) measurement of collector currents from the base metal electrode into the semiconductor as a function of tip-to-base bias voltage. The latter is a high-sensitivity (gain= 10^{11} V/A), low-impedance current amplifier. Topographical images with atomic resolution of highly oriented pyrolytic graphite have been obtained.

EVALUATION OF CR-SI ALLOYS FOR AEROSPACE STRUCTURAL APPLICATIONS

by

Joseph W. Newkirk

James Sago

ABSTRACT

Cr-Si alloys offer important advantages as an aerospace material, including high service temperature and good oxidation resistance. This in-situ composite combines a hard, brittle silicide phase with a softer chromium phase. The silicide phase has a high specific stiffness from room temperature up to 1400C. The soft phase is intended to add damage tolerance by bridging cracks and stopping them from propagating at low temperatures. Different volume percents of the two phases were evaluated and the bend strength measured as a function of temperature. Alloys with high volume percents of the silicide phase had good strength values at temperatures up to 1200C or more. Although toughness tests were not performed during this initial study, microhardness indents were used to demonstrate that the chromium phase could act as a crack bridging material. In addition the microstructural stability of these materials were studied with encouraging results. Finally, further study of these alloys is recommended and specific areas of study are included.

An Intelligent Neural Model for Recognition of Input/Output Patterns for a Molecular Beam Epitaxy Process

by

George H. Tompkins

ABSTRACT

This paper discusses the problem of pattern recognition as applied to the rapid characterization of a Molecular Beam Epitaxy (MBE) process. The MBE process is a complex and difficult process to control, typically resulting in low production yields. The characterization of new materials may take months before the process can produce quality, repeatable results. This paper reviews the application of neural networks to recognize patterns within the input/output relationship of MBE process variables. The objective is the ability to self-improve process knowledge and thereby decrease the time necessary to find acceptable ranges for producing quality parts. Further research is suggested in order to incorporate the concepts of neural networks into a Qualitative Process Automation (QPA) philosophy that will make the MBE process both "self-directed" and "self-improving".

HIGH RESOLUTION SCANNING ELECTRON MICROSCOPY OF PITCH-BASED CARBON FIBER

by

Deborah L. Uezie

ABSTRACT

New technology has created the demand for the development of high performance polymers to replace natural or metallic materials. In particular, the Air Force is investigating new polymer materials that have high tensile strength and modulus, and are thermally stable and environmentally resistant for structural use in airplanes and spacecraft. A problem with these polymers, however, is an inherently low compressive strength.

Due to their wide range of mechanical properties, carbon fibers are being investigated as a means to gain insight into what mechanisms control compressive strength of fibers. Once these mechanisms are understood, improvements in the compressive strength of high performance polymer fibers can be made.

High resolution, low voltage scanning electron microscopy was used to determine structure-property correlations of pitch-based carbon fibers. Sheet-like structures were seen in all fibers. Lower compressive strength, higher modulus fibers had more oriented sheets, whereas higher compressive strength, lower modulus fibers showed less oriented sheets, which corresponds to wide angle x-ray diffraction studies.

ABSTRACTS
HARRY G. ARMSTRONG AEROSPACE MEDICAL RESEARCH LABORATORY

Research Into Semen Analysis as a Sensitive Indicator of Neurotoxicity

by

R.M. Barbaro and J.R. Cooper

ABSTRACT

Air Force, Navy, and Marine Corps personnel are routinely exposed to a variety of potentially neurotoxic substances. The sooner adverse consequences resulting from exposure to these agents are detected, the sooner measures can be taken to prevent irreparable damage. The purpose of this study was to determine if analysis of semen can be used to indicate neurological damage caused by exposure to volatile chemicals. Three projects were initiated to prepare for this investigation. First, ceramic glass reservoir systems were fabricated using high density (2.628 ± 0.046 g/cm^3) ALCAP ceramics. This system provided for the slow release of the test chemical, 1,1,1-trichloroethane in the animal. Second, a system to detect 1,1,1-TCE using a GC-FID rather than a GC-ECD was investigated. Finally, the computerized semen analyser was set up and a familiarity with the system was gained.

Metabolism of 2-Methylheptane in Fischer 344 Rats

by

J. Matthew Clemens

ABSTRACT

Fischer 344 Rats were intragastrically dosed with 2-methylheptane and the 48 hour urines collected. The urines were enzymes processed and then used for Gas Chromatographic (GC) metabolite analysis. Possible urine/metabolites were either purchased or synthesized in the lab. Urinary metabolite peaks were observed by comparing the GC tractings of dosed rats to those of control rats. The observed metabolite peaks were identified by matching their retention times to the retention times of metabolite standards with known structures. If the retention times were very similar, a small sample of urine was spiked with the standard to see if peak area grew. Four metabolites were identified in this manner. These metabolites were: 2-methyl-1-heptanol, 6-methyl-3-haptanol, 6-methyl-1,2-heptanediol, and 2-methyl-1,2-heptanediol.

Harness Belt Task

by

Joseph Szucs (Summer Faculty Research Fellow)

Vincent Dimiceli (Graduate Student Research Fellow)

ABSTRACT

A new version of the Harness Belt Option of the Articulated Total Body (ATB) model [3,8,9] has been constructed. This new model minimizes the total elastic potential energy of the harness system under the following constraints: (1) the component of the belt tension force that is perpendicular to the body surface is balanced by the deflection force exerted by the body due to deformation; (2) the friction force created by the belt tension force is not smaller in magnitude than the component of the belt tension force that is tangential to the body surface. It was found by us that the old version of the Harness Belt Option does not minimize any function, it only imposes constraints (1) and (2) with the difference that in (2) it stipulates that the friction force is not smaller in magnitude than those two components of the tension force that are tangent to the body surface and are parallel and perpendicular to the belt line. These constraints are physically wrong and do not determine the motion of the harnesses uniquely. This causes the failure of the old model.

We have started computer implementation by writing two new subroutines.

A Study of Transport Delay Using an Aircraft Simulator: Pilot Study

by

Lawrence Blair Fleischer

ABSTRACT

A study was designed to test the effects of Transport Delay on pilots who train using simulators. A high performance aircraft simulator was created. A side-step landing task, first used by Calspan Corp. to study of Transport Delay, was programmed into the simulation and used as the primary task. A scoring algorithm provided a performance measure as well as a means to give simulator users feedback to improve aircraft control. The purpose of this pilot study was to determine whether the information displayed from the scoring algorithm provided adequate feedback to allow participants to improve their score in subsequent trials.

There was a general improvement in scores as the test participants became accustomed to the simulator, however the improvement was not as large as expected due to the lack of qualitative feedback given with the performance scores. To improve feedback to participants, it was recommended graphic displays of the ground track and glide slope be provided in addition to the numeric overall score originally presented.

Maternal Transfer of Hexachlorobenzene in the Rat

by

Ellen S. Goldey

ABSTRACT

The uptake, distribution, and elimination of hexachlorobenzene (HCB) was assessed in nonpregnant, pregnant, and lactating rats, and their fetuses and suckling pups. Three weeks prior to breeding, virgin Sprague-Dawley rats were given a total oral dose of HCB in corn oil of 11 mg/kg body weight over three days. Concentrations of HCB were determined in the tissues from animals three weeks after dosing (at breeding), on day 21 of gestation and on postnatal (PN) days 7, 14 and 21. In all reproductive states of the dam, the fat had the highest concentration of HCB, followed by the liver, blood, kidney and brain. During pregnancy, the fetal blood and liver concentrations were 0.9 times the maternal blood HCB concentration, and the fetal brain HCB concentration was 0.5 times the dam blood HCB concentration. The maternal body burden of HCB was quickly depleted by lactational transfer of the HCB to the suckling pups as reflected in high HCB concentrations in the milk. By PN day 7, concentrations of HCB in dam tissues were approximately one third their initial concentrations, and by PN 14, HCB was only detected in the fat. On PN day 7, pup liver, blood, and kidney HCB levels were about 5 times the respective maternal tissue HCB levels, whereas the pup brain HCB concentration was 1.5 times the maternal brain HCB concentration. Tissue concentrations of HCB in nonpregnant females, measured at two week intervals over six weeks, showed a gradual decrease over the duration of the experiment.

EFFECTS OF DATA ERROR ON PROBLEM-SOLVING HEURISTICS

by

Bonnie J. Walker, Ph.D.

and

David R. Harper

ABSTRACT

The effects of two levels of system failure on scientists' and pilots' problem-solving heuristics using the Wason 2-4-6 rule induction task were assessed. Results indicated that most subjects preferred to test their hypotheses by examining evidence which would confirm their ideas. Subjects given system failure conditions were less likely to solve the task and used significantly more tests and test replications. Furthermore, the heuristics used to solve the task in the current study were very similar to those used in earlier studies which had utilized undergraduate subject pools, demonstrating that advanced education and scientific experience does not necessarily change problem-solving styles.

THE PHYSIOLOGICAL EFFECTS OF DOBUTAMINE ON THE CARDIOVASCULAR SYSTEM

by

Deborah E. Hollenbach

ABSTRACT

Dobutamine is a pharmacological agent that acts on beta-1 receptors in an inotrophic manner to increase myocardial contractility. Due to this action, dobutamine has been selected as a possible agent to be used to decrease the body's susecptability to G/LOC. G/LOC occurs when there is a critical reduction of cerebral blood flow as a result of increased G-force. Dobutamine (0, 20, 40, 60 mg/kg/day) was prepared in normal saline and infused for two hours a day, five days a week, for six weeks, into miniature swine. The animals showed a significant dose-dependent increase in heart rate during infusion. The heart rates were 62 $\pm$2, 144 $\pm$ 2, 172 $\pm$ 2, and 181 $\pm$ 3 during the infusion process. Systolic blood pressure (110 $\pm$ 3, 99 $\pm$ 2, 86 $\pm$ 2 and 77 $\pm$ 3) and diastolic blood pressure (68 $\pm$ 2, 56 $\pm$ 2, 43 $\pm$ 2, and 40 $\pm$ 2) decreased in a similar dose-dependent manner.

Investigation of Selspot II Motion Analysis System Response to Impact Conditions

by

Laura A. Pytel

ABSTRACT

The Selspot II Motion Analysis System was obtained to test under impact conditions. A pendulum-like motion standard was designed to fit on an impulse accelerator sled. Tests were run to determine the accuracy and integrity of the Selspot II system under acceleration levels up to 24 Gs.

Minor changes were made with the Selspot II cables to avoid a disconnection with the cameras which occurred at the 20 G level. A correction was made on the Selspot II data to account for camera vibration by a rotation of the data plane to fixed targets. The accuracy of the Selspot system's analysis of the pendulum-like motion standard was then determined through comparison to a high resolution potentiometer mounted on the pendulum.

Preliminary results point to the conclusion that the accuracy of the Selspot II system will remain under 1% of the measuring range during accelerations conditions below 21 G's.

Speech Coding and Feature Recognition with a

Backpropagation Neural Network

by

Janet Slifka

ABSTRACT

The backprogation (bpn) neural network was investigated in relation to speech coding through the use of an identity mapping network. Training a 50-20-50 network produced a mean square error on the order of 0.01. From this it was concluded that all essential speech information was compressed to 20 points from 50 points. These compressed points were fed into another bpn network whose goal was to determine if the data presented was a vowel, consonant or silence. Preliminary testing in this area was conducted, producing several areas for further research.

ABSTRACTS
HUMAN RESOURCES LABORATORY

Career Progression in Air Force Enlisted Personnel: An Examination of Two Alternate Criterion Measures

by

David J. Woehr

and

John A. Butemeyer

ABSTRACT

Two career progression measures for USAF enlisted personnel were examined as possible alternate criterion measures to training school final grades in ASVAB validation studies. One measure, Skill Level Acquisition Rate (SLAR), was found to have too little variance at lower levels and failed to show a substantial relationship with aptitude measures to serve as a viable criterion measure. The other measure, Grade Level Advancement Rate (GLAR), however was demonstrated to be a potentially valuable alternative criterion measure.

Ms. Patricia Cooper
1988 Graduate Student Participant
No Abstract Submitted

Working Memory and Cognitive Structure

by

Kathryn F. Cochran
Alice Horton

Abstract

The research described in this report was designed in the context of the Learning Abilities Measurement Program conducted at AFHRL, Brooks AFB, Texas. The goal of this research was to investigate the influences of working memory and prior knowledge on the development of conceptual information stored as declarative knowledge in memory, and it is based on the theoretical conceptions of working memory developed by Baddeley and Anderson, and advances in the measurement of this construct made at AFHRL. A modification of Novak & Gowin's concept mapping procedure was developed for computer presentation, and was used as pretest and posttest measures of conceptual understanding in a test battery with five measures of working memory.

Due to unforeseen software incompatibility problems, the data analyses for this research are incomplete. The process of transferring floppy disk information to the mainframe computer at the University of Northern Colorado was more complex and time consuming than expected. This report was delayed as long as possible, but these problems could not be resolved before Oct. 1. A complete final report will be submitted as soon as possible.

Evaluation of Air-Intercept Performance: Observer Reliability Issues

by

Phillip D. Tomporowski

and

Royce Simpson

ABSTRACT

Four F-16 Instructor Pilots viewed videotaped Radar-Electro-Optical (REO) and Head-Up (HUD) displays of 16 air intercepts performed by student pilots. A 16-item rating form was employed to evaluate each intercept. A 5-point rating scale was used. Ratings were made of three types of intercepts: head-on, beam, and front quarter. Analyses were made of Instructor Pilots' ratings when the three intercept types were combined and when the intercept types were separated. Interrater agreement was greatest on global evaluations of performance; there was less agreement among the scores of raters on specific air-intercept maneuvers, particularly radar utilization. Improved observer reliability may be engendered through the use of rater-training sessions to familiarize them with the behaviors to be assessed and the evaluation criteria to be employed.

Integral Displays in
Interactive Dynamic Environments
by
Mona L. Toms

ABSTRACT

Prior research has indicated integral displays are effective in tasks where information needs to be integrated prior to a response. A literature review of research in this area has found that the effectiveness of integral displays has not been investigated in interactive dynamic environments that characterize command and control, logistics, and air defense domains. This report discusses problems that are characterized by these types of environments, identifies relevant research issues, discusses how integral displays may facilitate as decision support, and recommends an experimental design to test these issues.

Software Development to Support Data Collection and Analysis of Cognitive Task Analysis Studies

by

Christopher Bell Ron VanEtten

ABSTRACT

The Air Force Human Resources Laboratory (AFHRL) is engaged in a series of projects to capture expert knowledge and strategies to facilitate training of novices and to hasten the acquisition of expert level skills. The summer project has developed software to automate and simplify the capture and analysis of Precursor / Action / Result / Interpretation (PARI) data (both text and graphics) by the AFHRL personnel. An existing standard software package (dBASEIII+) has been modified, significant extensions made to the available knowledge base concerning aspects of this package and new software modules created and tested to achieve this automation. A hypertext system was evaluated to permit the analysis of data across problem domains. The project has demonstrated the utility of dBASE III+ as a file management system for complex file interactions in a portable computer environment.

Work in applying expert system strategies for automating the analysis stage and in the hypertext based extraction of common themes will lead to further increases in the productivity of AFHRL researchers.

An Evaluation of Stereoscopic 3D Computer Displays

by

John E. Williamson

ABSTRACT

While the principles for creating stereoscopic illustrations have been known for over 150 years, very little applied research has been conducted on determining the benefits of such a presentation. The majority of stereoscopic research has tended to focus on the psycho-physiological aspects of stereoscopic vision in an attempt to localize the cognitive structure which merges the two disparate images. Past applied research has not given conclusive evidence that stereoscopic 3D presented materials improve performance when compared to traditional 2D presentation. Often no difference is found between the 2D and 3D groups, very small samples were used or the results could not be replicated.

Traditionally research into stereoscopic 3D benefits has not examined reaction time as a dependent variable. It is felt that reaction time, rather than accuracy, is a variable which may demonstrate that stereoscopic 3D presented materials can lead to better performance over 2D displays. Several methods of 3D presentation are discussed and a series of experiments which use reaction time are proposed.

Note: The use of the terms "3D" or "three-dimensional" in this paper refers to stereoscopic or true 3D, where the image appears to have volume. Often these images will look as though they are floating behind or in front of the computer screen much like 3-D movies and the popular ViewMaster children's toy. This definition differs from the use of the phrase "3D" in today's computer terminology. This use refers to the representation of 3D objects in a flat 2D space such as a photograph. This technique is often more accurately referred to as "2 1/2D" or solid/shaded (Figure 1).

ABSTRACTS
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY

BIOLOGICAL ANALYSIS OF THREE PONDS AT PETERSON AFB, COLORADO SPRINGS, CO

by

Gregory Zagursky

William H. Jefferson III

ABSTRACT

A series of three man-made ponds on the golf course at Peterson AFB, Colorado Springs, CO were analyzed to determine their current ecological status and future potential for recreational fishing. Biological analysis consisted of collection, enumeration and identification of organism from the water column and sediment from three sampling sites at each pond. The ponds were evaluated on the basis of species diversity and the types of species present. Chemical analysis of water and sediments for toxicants was also performed.

The results indicate that ponds 1 and 2 are in excellent ecological condition and should be able to maintain stocked game fish which are safe for human consumption. Pond 3 cannot be recommended for stocking with fish in its current condition. Low species diversity and the presence of pollution indicator species suggests that this pond is being stressed by an unknown pollutant. The most like source is a storm drain which may be chronic source of pollutants for this pond.

STATISTICAL ANALYSES OF DATA PERTAINING TO GROUND WATER CONTAMINATION AND LABORATORY QUALITY CONTROL

by

Barbara Alvin

and

Lisa Newberg

ABSTRACT

Statistics were used to summarize and analyze data sets which were collected in the Installation Restoration Program, a program which is managed by the Air Force Occupational and Environmental Health Laboratory. Different methods of summarizing ground water contamination data were explored. The results of different ways of treating the data were compared.

In addition to comparing methods of treating data on ground water contamination, data from quality control samples were summarized. This data had been collected to monitor the precision and accuracy of the contracting labs which measure the concentrations of analytes of interest. Methods for determining limits on the percent recovery of an analyte and the standard deviation of that percent recovery were explored.

ABSTRACTS
SCHOOL OF AEROSPACE MEDICINE

Investigation of the Release of Glutamate and Dynorphin A(1-8) by Hippocampal Mossy Fiber Synaptosomes Through Chemical and Electrical Stimulation.

Sudar Alagarsamy

Abstract

The hippocampi of male Hartley Guinea Pigs were dissected, homogenized and subjected to a density gradient separation to yield the mossy fiber terminals. These synaptosomes were exposed to a variety of glutamate agonists and antagonists as well as potassium ion stimulation and electrical stimulation. Four minute fractions were collected from the treated synaptosome preparations and the superfusates were analyzed for glutamate and dynorphin A(1-8). Quantification was accomplished by an enzyme mediated fluorescence assay to determine the amount of glutamate and a radioactive binding assay to determine the amount of dynorphin A(1-8).

INVESTIGATION OF PICOSECOND PULSES FROM A CW Q-SWITCHED ACTIVE MODE-LOCKED LASER

by

John W.J. Barnaby

ABSTRACT

The CW Nd:YAG laser using Q-switching and active mode-locked excitation generates ultrashort laser light pulses(1). These picosecond pulsewidth pulses will be investigated using a Hamamatsu M1952 High Speed Streak Unit and C 1587 Temporaldisperser. In addition photometric data and streak images were graphed for both a 1064 nm beam and a 532 nm second harmonic generated beam.

PCR-Analysis and in situ Detection of Ureaplasma urealyticum and Mycoplasma hominis

by

Paul Calvo and
Vito G. Del Vecchio

ABSTRACT

Three DNA probes which were specific for either U. urealyticum or M. hominis were used as models for PCR analysis. The sequence and composition of these target sequences are in the process of being determined in order to profile their restriction endonuclease sites and to synthesize oligonucleotide primers. These primers will define and limit in vitro amplification of only target sequences.

In situ DNA hybridization using biotinyiated probes and an FITC-streptavidin signal was proven to be specific and offer the ultimate sensitivity for elucidating the presence of these organisms in artificially infected tissue cultures as well as clinical samples. The probe for Ureaplasma DNA was specific; however, that for Mycoplasma displayed some cross reactivity with Ureaplasma DNA. Investigation of stringency may render the Mycoplasma probe more specific.

Glutamate Involvement in the Photic Entrainment of Activity Rhythms in Hamsters

by

Brian A. Davis

ABSTRACT

A preliminary investgation of light-induced phase shifts of the free-running activity rhythm in male Syrian hamsters was conducted to determine the role of excitatory amino acid neurotransmitters in the photic entrainment of the circadian pacemaker. In the first experiment, hamsters were exposed to a 15 minute pulse of 33 lux (n=5), 250 lux (n=5), 2850 lux (n=6) and > 20,000 lux (n=1) of white light to determine the photic stimulation condition which resulted in a sub-maximal phase shift of the free-running activity rhythm. Exposure to a 15 minute pulse of 250 lux of white light resulted in the most consistent phase shifts. However, no significant effect of light intensity on the magnitude of the phase shift was observed. In the second experiment, the effect of microinjections of 0.3 uL of 10 mM kynurenic acid (KA) or artificial CSF (aCSF) vehicle administered directly into the suprachiasmatic nuclei (SCN) via a stereotaxically-implanted guide cannula on the free-running activity rhythm was determined. No significant effect of KA was observed. Unfortunately, we were unable to conduct the final experiment designed to determine if light-induced phase shifts of the pacemaker could be blocked by KA microinjection. The procedures developed during my tenure at the School of Aerospace Medicine provided a founda-tion for future studies of the neurochemistry of photic entrainment of the SCN circadian pacemaker in hamsters.

MAGNETODECTION BY ANIMALS

by

Dagmar C. Fertl

ABSTRACT

A literature review of orientation by animals using the earth's magnetic field was prepared (TP-89-). A photoreceptor-based mechanism, optical pumping, has gained the interest of many scientists. Of particular interest are the biological and physical implications that the blowfly Calliphora vicina possesses this ability. It also appears that magnetic fields intertwine the visual system and the pineal gland. The report discusses the before mentioned and its significance for the medical field and the study of acuity of night vision in pilots.

Cryopreserving Chlamydomonas reinhardtii

at -70°C by the Two-step Cooling Method

by

George G. Kim

ABSTRACT

A protocol was developed for cryopreserving Chlamydomonas reinhardtii algae, strain 125, by gathering as much information within the ten week period as possible. A storage temperature of -70°C was found to be lethal to the cells. A -196°C storage temperature should provide greater survival. Further experiments, using the final protocol, should produce significant numbers of viable cells surviving after cryopreservation.

STATISTICAL MODELS IN SOCIAL DYNAMICS

by

Teresa Lee

ABSTRACT

Sociological theories become increasingly concerned with social changes. It is not enough to address the social phenomena merely from either the static point of view or the cross-sectional analysis. Sociologists move on to analyze the actual time paths of change in attributes of individuals and/or societies. While studying statistical models in social dynamics, I concentrate my research on the event history analysis.

A RESEARCH OPPORTUNITY AT BROOKS AIR FORCE BASE; A MULTI-FACETED EXPERIENCE

by

Cynthia L. Moorhead

ABSTRACT

The following paper is a brief report on the various projects this researcher was associated with over the summer research period. My primary project assignment was the isolation of catecholamines from blood plasma of test subjects obtained during the tyrosine study conducted at Brooks AFB over the period of September to December 1988. Mechanical difficulties encountered in the laboratory during my research assignment prevented further work on the catecholamine analysis. To date, this portion of the tyrosine study remains incomplete. Therefore, this researcher had the opportunity to participate in several other projects being conducted at the Crew Technology Division of USAFSAM.

System and Signal Analysis of VEP Data and Joystick Error Analysis

by

Harold Longbotham,
Lionel Ramos,
and Joe Rea

ABSTRACT

One of the missions of SAM/RZV is the analysis of deterioration of the combat readiness of Air Force pilots due to flash blinding and laser eye damage. At RZV research is being conducted into methods of measuring visual acuity of unresponsive subjects using the visual evoked potential. Research will be conducted on the ability of pilots to perform eye tracking with artificial scatomas that simulate laser eye damage. Simultaneously work is in progress in image processing to model the visual field so that perturbations to it, due to laser damage may be simulated. Our research in this area resulted in the submission of two papers in image processing to the 1990 SPIE/SPSE conference, the submission of technical reports on analysis of joystick error and analysis of system error in VEP instrumentation, a literature search on robust methods (in statistics) that may prove applicable to VEP data analysis, and the outline of an expository paper on linear and nonlinear digital filtering and experimental design for data analysis with specific applications to VEP data.

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PCR-Analysis and in situ Detection of Ureaplasma urealyticum and Mycoplasma hominis

by

Paul Calvo and
Vito G. Del Vecchio
and Raymond Wolfe

ABSTRACT

Three DNA probes which were specific for either U. urealyticum or M. hominis were used as models for PCR analysis. The sequence and composition of these target sequences are in the process of being determined in order to profile their restriction endonuclease sites and to synthesize oligonucleotide primers. These primers will define and limit in vitro amplification of only target sequences.

In situ DNA hybridization using biotinylated probes and an FITC-streptavidin signal was proven to be specific and offer the ultimate sensitivity for elucidating the presence of these organisms in artificially infected tissue cultures as well as clinical samples. The probe for Ureaplasma DNA was specific; however, that for Mycoplasma displayed some cross reactivity with Ureaplasma DNA. Investigation of stringency may render the Mycoplasma probe more specific.

ABSTRACTS
WILFORD HALL MEDICAL CENTER

DENTAL MATERIALS

by

Terrance Jorden

ABSTRACT

The fluoride leach of seven commercial liners and bases was investigated. Two liners which contain calcium hydroxide and are polymerized by visible light, (Prisma VLC Dycal) and Cavalite (Kerr), were compared with a capsulated "Bonded-base" cement (ESPE Ketac-Bond applicap) and two glass ionomer lining cements: Shofu lining cement and XR ionomer lining cement. Timeline, Vitrabond, and Ketac bonding cement were also used.

The strength of different types of pin-retained amalgams was investigated. Stainless steel pins: Stabilok small diameter, MPS, TMS minum, DENLOK, TMS Link Series (Whalecent) and one SS goldplated TMS Minum (Whalecent) were compared with 3 titanium pins: Filpin, Stabilok 6mm and TMS Link Plus.

A pin-pull was also conducted with the use of the Instron testing machine. The project consisted of testing the retention in dentin of eight different pins.

"Temperature Effects on Erythrocyte Sedimentation Rates in Whole Blood and on Erythrocyte and Platelet Volumes"

by

W. Drost-Hansen
and John Lafferty

ABSTRACT

Erythrocyte sedimentation rates in whole, anticoagulated blood have been measured over a wide temperature range (26°C to 53°C) at closely spaced intervals (0.7°C or 0.9°C). Anomalous sedimentation rates are frequently observed near 30°-32°C, and at 45° (±1°)C the sedimentation rate decreases abruptly and dramatically in all sample studies (human, baboon, pig, dog, goat). The temperatures of the two anomalies coincide with the temperatures at which vicinal (i.e., interfacially modified) water is known to undergo structural transitions. In blood from humans, baboon and pig the mean cell volume (MCV) goes through a maximum around 42°-43°C, followed by a minimum near 45°C and a dramatic, large and narrow peak around 49°-50°C. Mean platelet volumes (MPV) for humans, baboons, and pigs generally go through a broad minimum around body temperature (37°-38°C) followed by a peak around 46°C. The values for MCV and MPV (and the temperatures at which the maximum and minimum occur) are not affected by the transmembrane enzyme blockers Digoxin or Verapamil. (A small effect on initial sedimentation rates is observed with Verapamil. After 2 or more hours of incubation, this effect disappears.) The heat-induced changes in MCV and MPV show notable hysteresis: the values of these parameters remain unchanged after subsquent incubation at 24°C for at least 2 hours. Sedimentation rate measurements have also been made at 25°C and 37°C on blood from 40 healthy, normal individuals and 30 patients with known pathologies. On the basis of the preliminary data analysis it has not yet been possible to determine if the temperature coefficient of the sedimentation rate based on these data may contain diagnostically useful information not revealed by the standard, room-temperature ESR.

Collecting Data and Occurrence of AIDS-Related Symptoms: Longitudinal Study of HIV U.S.Air Force Personnel

by

Paula Mellon

ABSTRACT

The U.S. Air Force screens all in-coming personnel and all symptomatic personnel for acquired immunodeficiency virus infection. Data from sero-positive personnel become part of the on-going longitudinal study which now contains more than 800 hundred cases. Data from successive in-patient admissions were obtained, reviewed, arranged chronologically, and entered into the data bank for future analysis. Data were entered into three mostly-discrete sub-studies: (1) spinal fluid immunoglobulin and electro-physiological determination of normal or abnormal neurological status (124cases); (2) neuropsychologists' yearly reevaluation test scores on a neuropsychological test battery then correlated with yearly re-samplings of cerebrospinal fluid (98 cases); (3) in-patient AIDS Service narrative summary dates and clinical course of opportunistic in-fections which meet Center for Disease Control definitions for AIDS-related symptoms (116 cases). The importance of attaining accurate data and the importance of this large and non-self-selected group of cases in elucidating accurate Life Table analysis and in promulgating future AIDS research is noted.

Comparison of Thromboelastography (TEG) versus Standard Hematologic Parameters to Predict Hemorrhage after Cardiopulmonary Bypass (CPB)

by

John Y. Salinas

ABSTRACT

Fifteen Patients were studied over a ten week period to study TEG versus more standard hematologic tests in an attempt to determine which tests are more predictive of post-operative bleeding complications. Specifically, cardiopulmonary bypass patients were selected for their increased post-operative bleeding complications and significant morbidity and mortality. Pre-operative and post-operative TEG's, bleeding time, prothrombin time, partial thromboplastin time, hemoglobin, hematocrit, platelet count, fibrinogen, and fibrin split products, activated clotting time, duration of bypass, duration of operation, and mean platelet volume were measured. Specific TEG parameters were also measured including R interval, angle of clot formation, k interval, and maximum amplitude of clot strength formation. Preliminary results indicate a significant difference between pre and post operative TEG parameters in concurrence with standard hematologic parameters.